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A LABORATORY STUDY OF SOME ANTISEPTICS WITH REFERENCE TO OCULAR APPLICATION*

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Among the chief obstacles to progress in the disinfection of living tissues is the lack of general realization of the great number of factors influencing the disinfection process and of the essential nature of the Law of Disinfection. The rate of the destruction of bacteria by any particular agent is influenced by the following factors: the kind of organisms; the degree of dispersion of the organisms (presence or absence of clumps); the presence or absence of organic matter; and the hydrogen-ion concentration and temperature of the medium. An important property of the antiseptic agent itself, which is not usually considered, and one which varies considerably between antiseptics, is the rate of decrease of disinfectant action with progressive dilution of the agent. The toxicity of the antiseptic, which determines the concentration that may be applied to the tissues, is of primary importance. The determination of phenol coefficients, which is the officially accepted method of evaluating antiseptics, gives no clue to the action of these various factors in practical application, since all the tests are run under an arbitrary set of conditions that may be quite foreign to the actual conditions of application.

The Law of Disinfection is generally misunderstood. When a killing agent is applied to a bacterial culture the organisms are not all killed at once. The decrease in the number of living organisms occurs progressively; the number dying during any unit of time being a certain fraction of the number living at the beginning of the period. The fraction depends upon the agent and upon the various factors mentioned above. Theoretically, therefore, and to a large extent practically, it is impossible to secure complete disinfection. The maximum we can hope for is to reduce the survivors to a point where we can expect sterility in one or more given samples.†

In the present work we have studied a number of antiseptics, keeping in mind the factors enumerated in the foregoing paragraphs. In the actual disinfection tests, certain of the factors influencing the disinfection rate (pH, temperature, and to a certain extent the concentration of organic matter) have been kept constant and as nearly similar as possible to those which are found in the eye. The first procedure was to determine what concentrations of the antiseptics could be used without injury to the tissues. Since it was not practical to carry out the necessarily very great number of tests upon the human conjunctiva, the tests for toxicity were made upon albino rabbits. It is the general experience that the conjunctiva of

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† For a more extensive discussion of the principles of disinfection see Isaacs.[1]

TABLE 1

DETERMINATION OF MAXIMUM NONIRRITATING CONCENTRATION

Estimated Inflammation at Different Periods

Antiseptic	Concentration percent	1st test		2nd test	
		1 hr.	18 hrs.	1 hr.	18 hrs.
Chlorazene	1.0	3+	3+	+	±
	0.25	+	±	±	0
	0.1	±	0	0	0
	0.05	0	0		
Alba*	0.3	2+	3+	3+	3+
	0.15	2+	+	2+	±
	0.075	+	±	±	0
	0.04	±	0	±	0
	0.025				
Acriflavine	0.25			+	2+
	0.1	+	+	+	2+
	0.05	+	0	+	±
	0.025	+	0		

Antiseptic	Concentration percent	1st test		2nd test	
		1 hr.	18 hrs.	1 hr.	18 hrs.
Gentian Violet	0.05	2+	2+	+	2+
	0.025	+	2+	+	+
	0.0125	±	0	±	0
	0.006			0	0
Iodine†	0.1	4+	2+		
	0.075	3+	+		
	0.05	2+	±	2+	±
	0.025	+	0	+	0
	0.015			+	0
Mercuro-chrome	5			3+	4+
	4			+	+
	3			+	±
	2	±	±	±	0
	1	±	0	±	0
	0.5	0	0		

Antiseptic	Concentration percent	1st test		2nd test	
		1 hr.	18 hrs.	1 hr.	18 hrs.
Merthiolate	0.4			3+	4+
	0.2			2+	+
	0.125	±	0	+	0
	0.05	±	0		
Phenyl mercuric nitrate	0.08	3+	4+	3+	4+
	0.04	3+	3+	3+	4±
	0.02	2	3+	2+	
	0.01	+	+	±	0
	0.005	+	±	±	0
Silver nitrate	0.5	2+	+		
	0.25	+	0		
	0.125	±	0		
	0.05	±	0		
Argyrol	50	0	0		

* Alba 211 is a mixture of high molecular Alkyl-dimethyl-benzyl-ammonium chlorides. The alkyls represent radicals derived from the fatty acids of coconut oil.

† The iodine preparation used was a standard Lugol's solution. The % figures represent the concentration of free iodine.

the rabbit is much more susceptible to chemical injury than is that of the human, so that concentrations of antiseptics which have been found nonirritating to the rabbit's eye may with a great deal of assurance be applied to the human eye.

The determination of the highest nonirritating concentration of antiseptics

Progressive dilutions of the various antiseptics were made in M/15 phosphate buffer of pH 7.4. Each dilution was tested on the conjunctiva of a 2-Kg. (ca.) albino rabbit. Two drops were instilled every five minutes until six instillations had been made. The eyes were carefully examined one hour and eighteen hours after the last instillation. The presence of discharge, edema, inflammation or injection of the conjunctivae, clouding of the cornea, or the presence of photophobia was noted and recorded.

The nontoxic concentration was defined as the highest concentration which would produce not more than a slight inflammation one hour after the last instillation, no trace of which should remain after 18 hours. The results obtained are summarized in table 1. Preliminary tests to obtain the approximate range of dilution are not shown. To save space only two tests for each antiseptic are shown although in most cases three of four independent tests were made, with degrees of correspondence equivalent to those recorded. It might appear that a very large subjective factor entered into the reading of these results, but actually the degree of correspondence between independent experiments in which the readings were made without knowledge of the concentrations used or of the previous results indicates that the tests are valid at least for purposes of comparison.

The disinfectant action of the nonirritating concentrations

A strain of Staphylococcus aureus was used in all the tests. Staphylococcus aureus is, in this country, probably the most frequent cause of operative infections of the eye. It is by far the most resistant of the organisms often associated with ocular or conjunctival infections. Biologically it is closely related to the streptococci and pneumococci, making it likely that the relative actions of antiseptics will be the same on these organisms.

The number of organisms per cubic centimeter of test mixture varied between one and seven million. The actual figures have little significance since the results are reported on a percentage basis. Before dilution the cultures were centrifuged at slow speed for three minutes to remove the larger clumps.

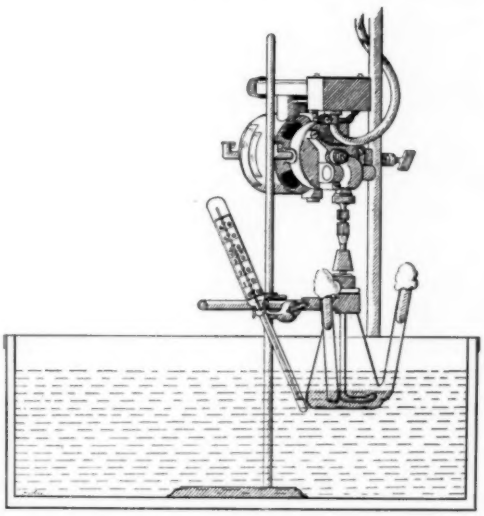

Fig. 1 (Thompson, Isaacs, and Khorazo). Apparatus for disinfection tests.

The medium in which the disinfectant tests were performed was designed to resemble tears as closely as practicable. According to Ridley,[2] the composition of human tears is closely approximated by a mixture of 10-percent serum with physiological saline. This is in general agreement with the various published figures as to the chemical composition of tears (Duke-Elder[3]). Since pH is one of the important factors governing disinfection, it was necessary to substitute an M/15 phosphate buffer of pH 7.40 for the saline. Fresh inactivated rabbits' serum to 10-percent concentration was added to the buffer just before the tests.

With one exception, noted below, all the disinfection tests reported here were made with the apparatus illustrated in the diagram. The organisms, suspended in the serum-buffer mixture, were introduced into the flask through the mouth. The flask was then suspended in

the water bath (37.5°C.) and the motor-driven stirrer was started. This stirrer served to keep the bacteria evenly suspended throughout the medium and to mix the antiseptic solution rapidly with the organisms when it was added later.

After a brief period a 1-c.c. initial sample (zero time) of the mixture was removed, with sterile precautions, through the left arm of the flask. Next, the amount of antiseptic to make the required concentration was introduced through the same arm. One-cubic-centimeter samples were taken out through the right arm of the flask exactly one and 10 minutes after the introduction of the antiseptic. All three samples were serially diluted with sterile tap water and plated with agar. The plates were counted after 48 hours' incubation and the numbers of surviving organisms per c.c. of fluid in the flask at the various periods were calculated.

TABLE 2

BACTERICIDAL EFFECT OF NONIRRITATING CONCENTRATIONS

Antiseptic	Maximum Nonirritating Concentration percent	Percent of Original Number of Organisms Surviving After:	
		1 minute	10 minutes
Merthiolate	0.1	84.7	70.9
Argyrol	50+{12.5 used	55.2	19.8
Phenyl mercuric nitrate	0.01	53.2	2.9
Gentian violet	0.01	45.4	0.01
Chlorazene	0.1	22.8	2.3
Acriflavine	0.05	19.8	0.46
Mercurochrome	2.	6.5	0.25
Silver nitrate	0.25	5.5	5.5
Iodine	0.025	1.	.39
Alba	0.04	0	

Disinfection experiments are subject to the variations normally found in biological work so that it was necessary to make a number of repetitions to establish the validity of the results. The figures reported in table 2 are averages of at least two experiments, in most cases of more than two.

In order to understand the significance of table 2 we must picture the processes involved. The disinfectant combines with the organisms and in many cases with the proteins of the medium. There is therefore a competition for the disinfectant between the organisms and the organic matter and, depending on the nature of the disinfectant, the reaction with the latter will be more or less rapid. Sooner or later the organic matter combines with enough disinfectant materially to slow or even to stop the disinfection process. The ideal disinfectant is one which has little or no combining capacity with the nonbacterial proteins and a large affinity for the bacteria. An inspection of table 2 indicates that from this point of view, iodine reacts somewhat faster with organisms than with the nonbacterial matter, but that after approximately one minute the active free iodine is reduced to a point where it is only slightly germicidal. Silver nitrate reacts more quickly with organic matter, and our results here and in other work would even indicate that the traces of active silver left after one minute actually have a stimulating action on the surviving organisms. The dyes have the most persistent action, although the process itself is very much slower than that with iodine. Chlorazene has an intermediate speed of reaction and a fair persistence. Mercurochrome showed up well on one-minute contact and its action persisted through the 10-minute period. The most rapid action of all was shown by Alba.

The results are also shown graphically

in figure 2. An inspection of the graph shows:

A. The steepness of the slope which registers the rapidity of disinfectant action.

B. The discontinuity of the curve, indicating slowing up or stopping of the disinfectant action by the removal of disinfectant by organic matter or possibly indicating lack of penetration of the agent into clumps of organisms. With a given disinfectant and a perfectly uniform suspension of organisms, disregrading organic matter, one would expect a straight unbroken line. If however, there are present in addition to single organisms small clumps of 2-10 (ca.) organisms, all the individuals of the clump would have to be killed before the plate count showed a diminution, since the count does not distinguish between individuals and clumps. The presence of clumps will therefore have the apparent effect of suddenly slowing the action after the isolated organisms have been killed, and in the case of disinfectants which do not penetrate readily this slowing will be greater.

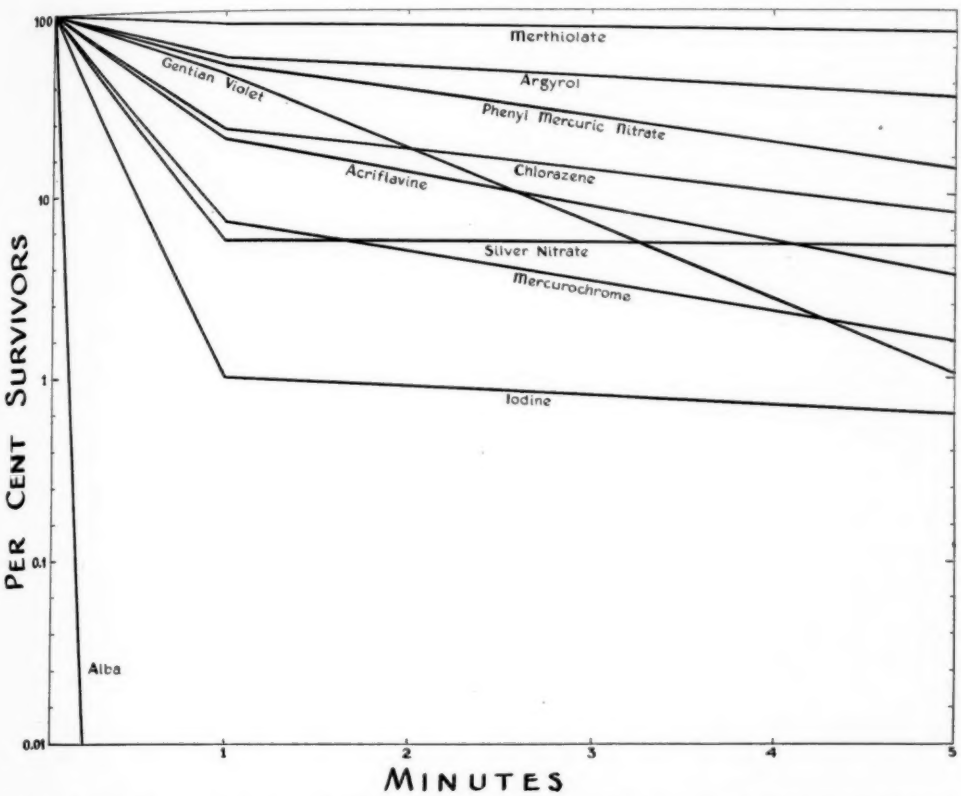

Fig. 2 (Thompson, Isaacs, and Khorazo). Disinfection rates of nonirritating concentrations. The figures for Alba were obtained by a method to be reported by one of us (M. L. I.) in which the antiseptic and organisms are kept in contact for approximately 0.3 second in a falling drop.

It will be seen that gentian violet ranks best in persistency of action, probably for the most part due to its penetrating action. The poorest showings are made by silver nitrate and by iodine, which, although undoubtedly penetrative, reacts very rapidly with organic matter.

The effect of an increase in organic matter

Under certain conditions an antiseptic may be called upon to act in the presence of more organic matter than is present in tears, as in the presence of mucus, pus, or tissue debris. According to the laws of chemical reaction one would expect that the increase in organic matter would favor the combination with it of the disinfectant to the detriment of the disinfectant-bacteria reaction. There is probably an underlying law which would permit the expression of this fact quantitatively; but for the present, lacking suitable data, we can only determine the effect of increased organic matter on an empirical basis and express the results in the form of a simple ratio. In table 3 are summarized the results of experiments designed to investigate the relative actions of the antiseptic in the presence of 10 and 20-percent serum. From the standpoint of the ratios expressed in the columns we can set down the following interpretations:

(1) The ratio approximates 1. This is interpreted as showing that the organic matter has no more effect in 20-percent than in 10-percent serum.

(2) The ratio is greater than 1. This indicates that the organic matter reacts with the antiseptic.

(3) The ratios of both time periods are equal. This indicates that the organic matter acts at about the same rate with the disinfectant as it does with the organism.

(4) The 10-minute ratio is greater than the one-minute ratio. This indicates that the reaction of the organic matter with disinfectant is definite but relatively slow.

Using these interpretations one would place among the disinfectants slightly influenced by protein, gentian violet, argy-

TABLE 3

Effect of changes in protein concentration

Antiseptic	Concentration percent	Percent of Original Number Surviving at 1 Minute		Percent of 1 Min. Number Surviving at 10 Minutes		Ratio: % Survivors 20% Serum / % Survivors 10% Serum	
		10% serum	20% serum	10% serum	20% serum	1 min.	10 min.
Gentian violet	0.01	45.4	55.3	0.027	0.04	1.2	1.4
Phenyl mercuric nitrate	0.064	32.5	35.2	1.7–	5.9	1.1	3.4
Argyrol	12.5	55.2	88.	36.5	36.1	1.6	1.0
Acriflavine	0.05	19.8	86.	2.3	8.	4.3	3.4
Chlorazene	0.01	59.	92.7	75.2	92.4	1.6	1.2
Alba	0.01	8.8	6.8	.03	8.6	1.	286
Mercurochrome	1.	66.4	79.6	7.24	50.3	1.2	6.9
Iodine	0.025	1.	3.4	39.	98.5	3.4	2.6

TABLE 4

Effect of dilution on antiseptics

Antiseptic	Value of n	% of Original Disinfectant Action in 1:1 Dilution
Merthiolate	0*	100
Argyrol	0*	100
Phenyl mercuric nitrate	0.5	90
Gentian violet	2	25
Chlorazene	2	25
Acriflavine	1	50
Mercurochrome	2	25
Iodine	2	25
Alba	1	50

* Within the range tested.

rol, and chlorazene; and among the slow reactors with protein phenyl mercuric nitrate, Alba, and mercurochrome.

The effect of dilution on disinfectant action

Antiseptics differ considerably in the extent to which their action is diminished by dilution. It is known that phenol diluted with equal volumes of water acts only one thirty-second as rapidly; whereas cresol loses only one half of its rapidity of action with similar dilution. Antiseptics introduced into the conjunctival sac undergo progressive dilution by the tears, so that the dilution factor may be of considerable importance in determining the duration of effective action. The measure of change in disinfectant action with dilution is expressed by a mathematical constant, "n." This value is computed from the percentage of organisms surviving in two different concentrations of antiseptics.*

Disinfection tests were done with varying concentrations of the antiseptics. The results, again the average of several experiments, are summarized in table 4.

The "n" values are given in the first column and translated into terms of percentage retention of disinfectant action after 1:1 dilution in the second column. It will be seen that argyrol and merthiolate do not appear to suffer at all from dilution. However, it would be erroneous to infer that a 1-percent argyrol would be as effective as a 12-percent because other evidence indicates that in more dilute solutions argyrol has an "n" value of about 2. Of the other agents, phenyl mercuric nitrate, acriflavine, and Alba stand dilution better than gentian violet, mercurochrome, or iodine.

The effect of antiseptics on the natural defense factors

In addition to irritation of the tissues, antiseptics may have an injurious effect upon the natural defense processes. Other factors being equal, an antiseptic which injured the leukocytes in lower concentrations would be less desirable than one which was not so injurious. In the tears there is an enzyme, lysozyme, which probably has considerable importance as a defensive factor, at least against the ordinary air contaminants. There is yet no agreement whether it offers any protection against the more pathogenic organisms. An antiseptic which did not inhibit the action of lysozyme might be considered more desirable than one which did.

The effect of the various antiseptics on leukocytes was tested by the slide-cell technique of Wright.[4] This was the method used by Fleming,[2] who showed that all the antiseptics which he tested destroyed the bactericidal power of the leukocytes in concentrations which themselves had no effect on bacteria.

Serial dilutions of the antiseptics were made in buffer phosphate of pH 7.4. One-tenth-cubic-centimeter amounts of these were mixed in small tubes with 0.8-c.c. quantities of fresh defibrinated rabbits' blood. A control tube contained blood and buffer with no antiseptic. The tubes were allowed to stand at room temperature for 15 minutes and then 0.1 c.c. of a standard staphylococcus suspension was added to each tube and well mixed. Slide cells, devised by Wright,[4] consisting of strips of vaselined paper between sterile microscope slides, were filled from the various tubes, sealed with paraffin, and incubated for 18 hours. The number of colonies in each cell was counted with the aid of a hand lens.

* Computed from the formula

$$n = \frac{\text{lolog } F_1 - \text{lolog } F_2}{\log \frac{C_1}{C_2}}$$

where F_1 = fraction surviving in C_1
F_2 = fraction surviving in C_2
C_1 = stronger concentration of disinfectant
C_2 = weaker concentration

TABLE 5

EFFECT OF IODINE ON BACTERICIDAL POWER OF RABBITS' BLOOD

			Concentration of Iodine in Final Mixture in %								
			.5	.25	.125	.062	.031	.015	.007	.0035	0
Number of colonies in chamber:	Exp. 1	1	0	0	55	35	20	10	12	15	10
		2	0	0	55	32	16	9	7	7	14
	Exp. 2	1	0	0	50	27	6	1	0	1	1
		2	0	0	45	26	3	0	1	1	1

Inhibition of growth to .25%
Definite injury to leukocytes to .062%

The absence of colonies indicated the inhibition of growth by the antiseptic, and a number of colonies significantly greater than that in the control cell (containing no antiseptic but only blood and staphylococci) indicated injury to the bactericidal power of the blood. Slide cells were made in duplicate and all experiments were repeated at least once, usually three times.

The agreement between experiments was close in all cases. The details of all tests cannot be given, but two experiments with iodine, shown in table 5, will make clear the nature of the tests.

Iodine up to 0.25 percent inhibited the growth of the organism in whole blood. Percentages of iodine between .125 and .062 not only did not inhibit growth but destroyed the bactericidal power of the leukocytes so that more organisms grew than did so in the control. The complete results of these tests are summarized in table 6, which shows the lowest concentration of antiseptic inhibiting the growth of staphylococci and the highest concentration causing definite injury to the leukocytes. The relationship between the figures in the two columns gives an indication of the possible relative value of the antiseptics as tissue disinfectants. The relationship has been expressed as a ratio indicating the multiples of the leukocytic injury concentration in the inhibiting concentration. Acriflavine stands highest, as no injury to leukocytes was evident with this technique. Fleming[5] reported that acriflavine does injure leukocytes if left in contact long enough, but this does not alter the comparative value of these figures. Due to its relative insolubility, no

TABLE 6

COMPARATIVE BACTERIASTATIC AND LEUKOCYTE-INJURING CONCENTRATIONS

	Lowest Concentration Preventing growth in Whole Blood (%)	Highest Concentration not Injuring Leukocytes In Whole Blood (%)	Ratio
Acriflavine	.003	.003+	1−
Chlorazene	.5	.25	2
Argyrol	2.5	.625	4
Gentian violet	.00025	.00006	4
Iodine	.25	.06	4
Merthiolate	.125	.03	4
Mercurochrome	.5	.06	8
Alba	.01	.001	10
Phenyl mercuric nitrate	Growth in all	.007	

TABLE 7

COMPARATIVE CONJUNCTIVAL IRRITATION AND LEUKOCYTE INJURY CONCENTRATION

Antiseptic	Highest Concentration (%) Producing:		Ratio
	(1) No Conjunctival Irritation	(2) No Injury to Leukocytes	
Acriflavine	.05	No injury evident	
Chlorazene	.1	.25	.4
Iodine	.025	.06	.41
Phenyl mercuric nitrate	.01	.007	1.4
Merthiolate	.1	.03	3.3
Mercurochrome	2.	.06	33.
Alba	.04	.001	40.
Argyrol	(25.)	.625	40.
Gentian violet	.01	.00006	166.

concentration of phenyl mercuric nitrate could be obtained that would inhibit bacterial growth without excessively diluting the blood.

Table 7 compares the highest concentration of antiseptics producing no conjunctival irritation with the highest concentration producing no injury to leukocytes. The ratio expresses the multiples of the leukocytic-injury concentration that can be used on the conjunctiva. In the usable concentrations of acriflavine, iodine, and chlorazene, we are using only a fraction of the concentrations that injure leukocytes (under the conditions of the tests); while with the other antiseptics, the usable concentration is in excess of the leukocytic injury concentration, varying from about one-and-a-half times for phenyl mercuric nitrate to almost 200 times for gentian violet. It is obvious that if we were to take leukocyte injury as the criterion for the quantity of antiseptic to be used, many of these substances would be eliminated from consideration, since the latter concentrations are often below the germicidal range.

THE EFFECT OF ANTISEPTICS ON LYSOZYME

The only previous report of the effect of antiseptics on lysozyme is that of Ridley,[2] who reported that some antiseptics commonly used in the eye impaired lysozyme action but gave no details of the methods used.

The method in this work consisted of determining the highest concentration of the substance that would cause no diminution in the dissolving action of a standard

TABLE 8

COMPARISON OF EFFECTS OF ANTISEPTICS ON CONJUNCTIVA AND ON LYSOZYME

Antiseptic	Highest Concentration (%) Producing:		Ratio
	(1) No Conjunctival Irritation	(2) No Diminution in Lysozyme Action	
Merthiolate	.1	.62	.16
Gentian violet	.01	.0062+	1.6
Phenyl mercuric nitrate	.01	.0012+	8.3
Alba	.04	.004+	10.
Acriflavine	.05	.004+	12.
Iodine	.025	.0005	50.
Chlorazene	.1	.001	100.
Mercurochrome	2.0	.002	1000.
Argyrol	(25)	.024	1040.

lysozyme concentration on a culture of sarcinae.

Equivalent quantities of progressive dilution of the antiseptics were added to the standard lysozyme dilution and mixed. After the mixtures had stood for 15 minutes amounts of sarcinae suspension equal to the total volume were added and mixed. Control tubes consisted of lysozyme and organisms with no antiseptic. Readings were made by comparing the clearing of the tubes containing antiseptic with the control tubes after incubation at 56°C. The end point was defined as the highest concentration of antiseptic which caused no diminution of lysozyme action; diminution of action being evident in a greater turbidity than that present in the control tube.

The results are summarized in table 8 and the concentrations compared with the nonirritating concentrations. The ratio indicates the multiples of nonlysozyme-inhibiting concentrations contained in the usable concentration. Plus signs following the figures indicate that some extraneous factors (density of color or precipitates) interfered with the readings, so that the end points may actually have been higher than indicated (that is, more favorable to the antiseptics concerned). The experiments were all done in duplicate or triplicate, the agreement being very good. With the exception of merthiolate, and possibly gentian violet, all of the usable concentrations are multiples of the lysozyme-injuring concentrations. Mercurochrome and argyrol are especially injurious.

Having investigated the disinfectants under the conditions simulating as closely as possible those in the eye, we may proceed to sum up the advantages and disadvantages of each. (A summary of properties is made in table 9.)

TABLE 9

SUMMARY OF RESULTS

Antiseptic	Relative Disinfectant Action	Persistency of Action	Drop in Action With 1–1 Dilution	Drop in Action By Increase of Organic Matter	Bacteriastatic Concentration / Leukocytic Injury Concentration	Usable Concentration / Leukocytic Injury Concentration	Usable Concentration / Lysozyme Injury Concentration
Alba	Best	Good	50%	Slow, but marked	10*	40.*	10.*
Iodine	Very good	Poor	75%	Marked	4	0.4	50.
Silver nitrate	Good	Least persistent		Very marked			
Mercurochrome	Good	Very good	75%	Slight	8	33.	1000.
Acriflavine	Moderate	Very good	50%	Marked	No injury		12.5
Chlorazene	Moderate	Good	75%	Slight	2	.4	100.
Gentian violet	Fair	Best	75%	Very slight	4	166.	1.6
Phenyl mercuric nitrate	Fair	Very good	10%	Slight	No bacteriastasis	1.4	8.3
Argyrol	Fair	Good	0	Slight	4	40.	1040.
Merthiolate	Poor	Good	0		4	3.3	.16

* The value of the disinfectant is in inverse proportion to these numbers.

1. Alba. This disinfectant is characterized by its extreme rapidity of action, far surpassing in this respect all the other disinfectants tested. It stands up moderately well under dilution. It is affected by the presence of organic matter, but relatively slowly as compared with such a disinfectant as iodine. It interferes with the normal bactericidal action of the blood quite markedly. It injures lysozyme action.

2. Iodine. Iodine acts as a powerful disinfectant for a relatively short period, after which its action is too slow to be relied upon. Its action is affected markedly by dilution. It is affected adversely by the presence of organic matter. It stands high in its lack of injury to leukocytes. It stands mid-way among the disinfectants tested in its injurious properties toward lysozyme.

3. Mercurochrome. This disinfectant is fairly rapid and persistent. In this respect it is one of the best of the substances tested. Its action is diminished by dilution to the same extent as iodine, but it is superior to the latter in its action in the presence of organic matter, although it does react slowly with organic matter. It is injurious to leukocytes and highly injurious to the action of lysozyme.

4. Acriflavine. Acriflavine acts moderately well as a germicide and its action is fairly persistent. It stands dilution fairly well. In the presence of organic matter its action is slowed. The apparent inconsistency between its persistence and the slowing of the action with organic matter may indicate that it has high penetrating powers or that its combination with organic matter is reversible. As acriflavine is known to be particularly susceptible to pH, there may be inflammatory conditions in the eye where its use, independent of other considerations, would be contraindicated. Of the antiseptics tested, it has the least injurious effect on leukocytes. In its action on lysozyme it occupies the median position.

5. Chlorazene is a disinfectant that has a moderate germicidal action, and this action is fairly persistent. Its action is slowed on dilution at the same rate as is that of iodine and mercurochrome. It stands up well in the presence of organic matter. Its injurious properties toward leukocytes are relatively low, but it is quite injurious to the action of lysozyme.

6. Gentian violet. The action of this dye is relatively slow but extremely persistent. Dilution affects it as much as iodine. Among the disinfectants tested it is influenced least by organic matter. It is, however, highly injurious to leukocytic action. Its action on lysozyme is slight.

7. Phenyl mercuric nitrate has a moderately slow but persistent action. Its action is not affected so much by dilution as is that of some of the other disinfectants. It is slowly affected by the presence of organic matter. It is moderately toxic for leukocytes and lysozyme. The preparation of solutions presents a problem, since the solid material is highly insoluble. It forms precipitates with chlorides, which may detract from its usefulness.

8. Argyrol is slow in action but fairly persistent. It is uninfluenced by moderate dilution and is only slightly affected by the presence of organic matter. It is moderately injurious to leukocytic action and highly injurious to the action of lysozyme.

9. Merthiolate works best in a highly alkaline medium, so that under the conditions of these tests it shows up poorly. It appears to be unaffected by dilution. It is moderately injurious to leukocytes, but stands highest in the list in its lack of injury to lysozyme.

10. Silver nitrate is moderately fast, but its action is of short duration due to its affinity for organic matter. It stands dilution fairly well. In the eye it is converted to silver chloride, the disinfectant action of which is largely dependent on the chloride content of the surrounding medium. Under ordinary conditions this would make the silver relatively inactive but persistent.

Summary and conclusions

The following properties of a number of antiseptics were determined: The disinfectant rate, under conditions simulating as closely as possible those which occur in human tears, of the highest concentrations nonirritating to the conjunc-

tiva; the influence of increased protein concentration on the disinfectant rate; the influence of dilution of the antiseptic on the disinfectant rate; and the toxicity of the antiseptic for leukocytes and for lysozyme.

The efficacy of the various antiseptics in removing organisms from the conjunctiva is certainly in great part determined by the properties listed above. We are not yet, however, in a position to weigh accurately the importance of the various positive or negative values and to say that one substance is superior to another; to say, for example, that a marked disinfectant action is or is not counterbalanced by an extreme toxicity for leukocytes. It is evident that the circumstances under which the agent is to be used would alter the weight given to the various properties. With repeated application in the case of an infection it is likely that leukocytic injury would be more detrimental than in removing organisms from the membrane with one application previous to operation.

References

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[3] Duke-Elder, W. S. Text book of ophthalmology. Mosby, Saint Louis, 1933, p. 639.
[4] Wright, A. E., Colebrook, L., and Storer, E. Lancet 1923, v. 1, p. 365.
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Discussion

Dr. Frederick Verhoff: I should like to ask if it made any difference as to whether the solutions were freshly prepared or not.

Dr. Richard Thompson: All the solutions were prepared just before use. We did not in any case determine the effect of aging solutions.

Dr. John M. Wheeler: Is Alba a proprietary substance?

Dr. Thompson: Yes, it is. It is being manufactured by a firm at present. I don't know whether it is patented or not.

Dr. Walter B. Lancaster: Would you tell us a little more about its composition, apart from its formula and the fact that it is made from cocoanut oil? It is not an oil, is it?

Dr. Thompson: No, it is miscible with water.

Dr. Lancaster: Is it an alkali?

Dr. Thompson: I don't know what the actual pH is, but it is not alkaline enough to change the pH of our buffer.

Dr. Verhoeff: You assume in that antiseptic action the actual killing of the germs. That is very important, but it might not be that. If you simply check the growth of the organism, you accomplish just as much, and you might be able to do that with very low concentrations, so that it is not so important to find out exactly the component as it is to know what concentration will inhibit the growth, and how much dilution will do it.

Of course, you get an idea how often to make an instillation. For instance, take the simple solution of boric acid and zinc sulphate so commonly used. If you tested it according to these tests, it would rank very low. But you will find that it will kill the staphylococci in 24 hours, which means that it is inhibiting their growth all the time, and therefore, if you use it frequently, it might be just as good as the other disinfectants. I would like to ask the essayist whether or not he considered that point of view.

DR. THOMPSON: We have shown some figures on the inhibiting effect in the whole blood. Personally, I am inclined to believe that a disinfectant which kills is more desirable than one which merely inhibits. Of course, I do not deny that the inhibiting action certainly is of value.

DR. JONAS FRIEDENWALD: How about the penetrating power?

DR. THOMPSON: I should have stated more about that. We discussed indirect evidence of penetrating power, but as far as direct measurements are concerned, we avoided them because at present we know of no method of measuring the penetrating power. *In vitro* methods have been proposed, but there is no reason for supposing that they measure at all the penetrating power in the tissues of the eye.

AN ETIOLOGIC STUDY OF A SERIES OF OPTIC NEUROPATHIES*

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This is the third etiologic study of the various optic neuropathies to be reported from the Johns Hopkins Hospital. In 1923 Woods and Dunn[1] reported a group of 86 ambulatory patients whose cases had been completely investigated in the clinic. In 1931 Woods and Rowland[2] reported a series of 137 patients all of whom were admitted to the wards of the Johns Hopkins Hospital (see table 5 for results of these studies).

From March 1, 1931, to March 1, 1937, there have been 6,632 patients admitted to the wards of the Wilmer Ophthalmological Institute, and among these were found 218 cases of optic neuropathies. Seven of these cases were due to trauma and so were discarded. Sixteen cases showed some complicating ocular disease, such as glaucoma or intraocular inflammation, which confused the picture and so were also discarded. There were also discarded seven cases of pseudoneuritis. Seventeen other cases were discarded because the diagnostic study was incomplete and no opinion could be expressed as to the etiologic factor. Twenty-one patients were under 15 years of age and these histories were put aside to be studied at a later date with a series of juvenile optic neuropathies admitted to Harriet Lane Home. There remained 150 case histories in which the diagnostic study was complete. All of these patients were over 15 years of age and had been admitted to the hospital primarily because of their ocular condition.

This diagnostic study included the following procedure: (1) ophthalmologic examination, consisting of external examination of the eyes, visual acuity, refraction, ophthalmoscopic examination, and perimetric and slitlamp examinations; (2) medical examination, including the usual physical examination and laboratory procedures; (3) neurologic examination; (4) laryngologic examination; (5) studies of the Wassermann reactions of the blood serum and of the spinal fluid; (6) X-ray study of the skull and sinus.

Throughout this paper the following terms are used with the same meanings outlined in the first paper of Woods and Dunn[1]

Primary atrophy: Atrophy involving the entire nerve, without the presence of

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visible, ophthalmoscopic evidence of preceding inflammation of the nerve.

Secondary atrophy: Any atrophy of the nerve in which there was present visible, ophthalmoscopic evidence of preceding inflammation; that is, obscuration of the physiologic cup, blurring of the lamina cribrosa, or deposition of glial tissue in the cup or on the nerve head.

Atrophy of the papillomacular bundle: An atrophic process especially localized in the papillomacular bundle, giving the clinical picture of pallor of the temporal sector of the nerve, diminished central vision, and normal field outlines for form, but with central or paracentral scotomas for either form or color.

Retrobulbar neuritis: Diminished central vision, normal fundus and nerve head according to ophthalmoscopic examination, normal field outlines for form, or concentric contraction, with the presence of central scotoma for either form or color.

Papilledema: A definite elevation of the nerve head. The subdivision of this group is based on whichever of the two etiologic factors—inflammation in the nerve or increased intracranial pressure—appears to be the predominating cause. Thus, when it was manifest that the papilledema was dependent on an inflammation in the nerve, the diagnosis of "optic neuritis" was made. Similarly, when it was manifest that the papilledema was primarily dependent on increased intracranial pressure, the diagnosis of "choked disc" was made. Until it appeared justifiable to make a diagnosis of either of these two conditions, the tentative diagnosis of papilledema was retained.

TABLE 1

ETIOLOGIC FACTORS IN 150 OPTIC NEUROPATHIES

	Brain Tumor	Pseudo Tumor	Syphilis		Arterio-sclerosis		Posterior Sinus Disease	Multiple Sclerosis	Focal Infection	Toxic Amblyopia	Leber's Disease	Intracranial Aneurysm	Scattering	Undetermined	Total
			Syphilis of the Central Nervous System	Secondary Syphilis	Embolus of Central Artery	Endarteritis of Nutrient Vessels									
Primary atrophy	14		21			2		3		1			1	4	46
Secondary atrophy	2	1			1	4	2	2		1			5	2	20
Retrobulbar neuritis			2				3	14	2	5				5	31
Papillomacular-bundle atrophy			1			1		5		3	2		1	4	17
Optic neuritis			2	3			1	2					3	5	16
Choked disc	7	4			1			1				1	4	2	20
Total	23	5	26	3	2	7	6	27	2	10	2	1	14	22	150
Percentage	15.3	3.3	17.3	2.0	1.3	4.6	4.0	18.0	1.3	6.6	1.3	.66	10.0	14.6	

RESULTS

Table 1 gives the composite results of this study. From the point of view of the clinical ophthalmologist there were 46 cases of primary optic atrophy, 20 cases of secondary optic atrophy, 31 cases of retrobulbar neuritis, 17 cases of papillomacular-bundle atrophy, 16 cases of optic neuritis, and 20 cases of choked disc. Of the primary atrophies 35 were due either to brain tumor or central-nervous-system syphilis. Two cases were secondary to arteriosclerotic changes, three to multiple sclerosis, and in four the cause could not be determined. There was no one condition especially responsible for the secondary-atrophy and optic-neuritis cases. An overwhelming proportion of the retrobulbar-neuritis and papillomacular-bundle

group were due to multiple sclerosis. Posterior sinus disease was the etiologic factor in but a few cases. The choked-disc group was largely due either to increased intracranial pressure caused by actual tumor or pseudotumor, or to orbital conditions.

The exact percentages of the various etiologic factors responsible for these different optic neuropathies are shown in table 1. Of the group as a whole 15.3 percent were due to intracranial tumor, 3.3 percent to pseudotumor, 17.3 percent to central-nervous-system syphilis, 2.0 percent to secondary syphilis, 5.9 percent to arteriorsclerosis, 1.3 percent the result of focal infection, 6.6 percent to toxic amblyopia, 1.3 percent to Leber's disease, 0.66 percent to intracranial aneurysm, 10.0 percent to widely scattered conditions, while in 14.6 percent the etiologic factor was not definitely determined.

An analysis of the individual etiologic groups yields the following data:

Intracranial-tumor group: There were 23 patients in whom the optic-nerve lesion was due to intracranial tumor. Table 2 shows the location and type of these tumors. There were nine hypophyseal tumors. In no instance was there increased intracranial pressure and all showed primary atrophy with characteristic visual-field defects—bitemporal or temporal field defect. In seven of these patients the tumor was demonstrated at operation. In the two remaining patients the diagnosis was made on the clinical and radiographic findings, but operation was not advised because of their age and poor general condition.

There were three cases of glioma of the frontal lobe. Two of these showed choked disc and the other showed a Foster Kennedy syndrome of papilledema of one eye and atrophy of the nerve in the other. In the latter case, at operation, a large glioma was found between the optic nerves and around them—more tumor tissue being on the side with optic atrophy.

There were six cases of dural endothelioma arising from the region of the sella turcica. Four of these cases showed primary atrophy and two a bitemporal hemianopia. One of the other cases showed lower-nasal-quadrant field defects in both eyes and the remaining case showed upper-temporal-quadrant defects. These four tumors all arose from the olivary eminence of the sphenoid bone. The two patients with dural endothelioma

TABLE 2

TYPES OF TUMORS

	Primary Atrophy	Secondary Atrophy	Choked Disk	Associated Ocular Motor Palsies	Visual-Field Changes	Increased Intracranial Pressure	X-Ray Changes in Skull	Total
Hypophyseal tumor	9				9		6	9
Dural endotheliomas in region of sella turcica	4	2			6		3	6
Frontal-lobe tumors			3		1	3	1	3
Tumors of cerebral hemispheres			3		2	3		3
Cerebellar tumors			1			1		1
Orbit and middle cranial-fossae tumors	1			1				1
Totals	14	2	7	1	18	7	10	23

of the olfactory groove showed secondary atrophy. Both of these patients had field changes and rather marked reduction in vision.

There was one case of tumor of the right orbit and right middle fossa. This encapsulated tumor was everywhere under the dura. Examination of the eyes showed primary atrophy on the right and complete internal and external ophthalmoplegia. The left eye was entirely normal. Peripheral visual fields were normal on the right but the central fields could not be accurately determined.

Of the remaining four cases which showed choked disc, in two there were no other ocular signs and at operation a cerebellar tumor was found in one patient and an astrocytoma in the tegmental region in the second. The third patient, in addition to the papilledema, had complete right homonymous hemianopia and at operation a left cerebral dural endothelioma was found. The fourth patient gave the history of removal of a pigmented mole from the skin of the back with an electric needle two years previously. At operation multiple metastatic nodules of melanotic sarcoma were seen on the surface of the brain.

Pseudotumor: There were five cases of optic neuropathies secondary to pseudotumor. All of these patients had marked increase in the intracranial pressure and showed choked disc. In only one case was there secondary atrophy. One of these patients is interesting in that when first examined there was bilateral papilledema, contraction of temporal fields, and variable paracentral scotoma. The vision at that time was 20/15 in both eyes. Complete examination was negative except for the ocular findings and increased intracranial pressure. Ventriculography was negative on two different occasions. The papilledema was known to have been present in this patient for ten months. After this period the intracranial pressure was relieved by subtemporal decompression. At the present time, almost five years after the operation, the vision is still 20/15 in both eyes and the results of the fundus examination are essentially normal. There is rather a marked bulging at the site of the decompression. All five cases were typical of serous meningitis. One of these cases is particularly interesting in view of the recent investigations of Woodhall,[3] who after noting the wide variation in the pattern of the intracranial venous sinuses in 200 autopsy specimens, suggested that inadequate venous drainage results in increased intracranial pressure. Such inadequate drainage might easily result from inadequate cross-circulation following the obstruction of one lateral sinus or from a small lateral sinus. This one case was the only one in which the history of otitic infection could be obtained or in which such infection was found. This patient had chronic mastoiditis on the right side. Examination of the eyes revealed papilledema of three diopters with normal vision and normal fields. The spinal-fluid pressure was 400 mm. of water. Ventriculography was normal. A subtemporal decompression and simple mastoidectomy were performed. The patient died before leaving the hospital and at autopsy, thrombi of right lateral and superior longitudinal sinuses were found.

Syphilis group: There were 29 patients in this group. Twenty-six of these patients had central-nervous-system syphilis. Of these, only 16 gave a positive Wassermann reaction in both the blood and spinal fluid. In seven patients the blood Wassermann was negative while the spinal-fluid Wassermann was positive at the time of the ocular examination, or had been demonstrated as positive at previous admission. This latter group illustrated the unreliability of a negative blood

Wassermann reaction in diagnosing the optic atrophy of central-nervous-system syphilis. Four patients in whom the spinal-fluid Wassermann reaction was negative showed on the neurological examination the picture of old, burned out, central-nervous-system syphilis.

Twenty-one patients showed primary optic atrophy. These cases were all bilateral and many brought out the fact that the pallor of the disc does not always parallel the degree of visual impairment. Eleven of these patients were found to have altered pupillary light reflexes varying from a sluggish reaction to a completely fixed pupil. Six patients were noted to have anisocoria. There were two cases of retrobulbar neuritis in whom there was marked reduction of the vision and central scotoma. These latter cases showed, in addition to positive Wassermann reaction of blood and spinal fluid, a slightly increased cell count and protein content of spinal fluid. Another case showed definite temporal pallor of discs, marked reduction in vision, and large central scotoma with normal peripheral fields. The general examination showed tabes dorsalis. The blood Wassermann reaction was positive and spinal-fluid reaction negative.

There were two cases of optic neuritis in which the diagnosis of acute syphilitic meningitis was made. One of these patients had a weakness of both external recti muscles in addition to the changes in the optic nerve. Examination of the spinal fluid revealed 358 cells per cu. mm. (lymphocytes), positive Wassermann reaction, and three plus Pandy. In the other case there were 93 cells in the spinal fluid, but five days after the first injection of arsphenamine the vision in the right eye improved from ability to detect hand motion at 10 feet to 20/40. The fields at that time just showed paracentral scotoma for color.

TABLE 3

CASES PRESENTING RETROBULBAR-NEURITIS—PAPILLOMACULAR-BUNDLE ATROPHY

	Multiple Sclerosis	Posterior Sinus Disease	Syphilis of the Central Nervous System	Arteriosclerosis	Focal Infection	Leber's Disease	Toxic Amblyopia	Postencephalitis	Undetermined	Total
Retrobulbar neuritis	14	3	2		2		5		5	31
Papillomacular-bundle atrophy	5		1	1		2	3	1	4	17
Total	19	3	3	1	2	2	8	1	9	48
Percentage	39.6	6.25	6.25	2.1	4.15	4.15	16.7	2.1	18.7	

Since only the patients who were admitted to the hospital are included in this study there are only three cases of secondary syphilis. These three patients had all had early syphilis inadequately treated, had lapsed in their treatments, and showed a classical ocular neuro-recurrence with the ophthalmoscopic picture of optic neuritis. One of these patients also had a peripheral seventh-nerve palsy and chancre redux.

Arteriosclerotic group: Vascular sclerosis was believed responsible for optic-nerve changes in nine cases in this series. It produced both primary and secondary optic atrophy depending on whether the retinal arteriosclerosis had been compli-

cated by papilledema. In one case the papillomacular bundle was chiefly affected. These changes are usually due to endarteritis of the nutrient vessels, but may be seen with occlusion of the central artery of the retina. None of these cases are particularly remarkable and their distribution is seen in table 1.

Posterior-sinus and multiple-sclerosis group: It is frequently extremely difficult properly to evaluate the role multiple sclerosis or posterior-sinus disease plays in the optic neuropathy of any given case at the onset of the condition. The later development of other neurological signs or the recurrence of visual impairment or both must often be awaited before a final diagnosis can be made. In this series of cases many of these patients have been readmitted to the hospital or followed in the clinics during the six-year period from which these cases have been selected. In many, the subsequent study made the diagnosis. In 11 patients seen with two or more exacerbations of the condition, eight showed only impaired vision, either alone or associated with palsy of one or more of the extraocular muscles, as the first symptom. Thus, while it is true that the diagnosis of multiple sclerosis cannot be made on the basis of retrobulbar neuritis alone, in the absence of other neurological signs and a negative survey of the patient, many of these patients if followed over a period of years will develop positive signs of the disease. Table 1 shows that while multiple sclerosis in some period of its course may present the ophthalmological picture of any of the optic neuropathies, it caused retrobulbar neuritis in half of the total number of cases. In 14 of the 27 cases X-ray examination showed the sinuses to be definitely normal, and in six other cases the sinuses were explored and ruled out as an etiologic factor. In three cases a tonsillectomy was performed. Ventriculography was done in eight cases and in three cases an exploratory craniotomy was performed. Examination of the cerebrospinal fluid was made in 18 patients. Four of these were found to have an elevation of cell count (20 to 100 cells per cu. mm.) and in only three cases was

TABLE 4

DISTRIBUTION OF CASES AS TO RACE, SEX, AND AGE

	Total	Race		Sex		Age			
		White	Colored	Male	Female	15–24	25–44	45–64	65 and over
Brain tumor	23	22	1	7	16		14	8	1
Pseudo tumor	5	5		2	3	2	1	2	
Syphilis	29	25	4	21	8	2	13	14	
Arteriosclerosis	9	9		7	2		1	2	6
Posterior-sinus disease	6	6		4	2	1	3	2	
Multiple sclerosis	27	26	1	16	11	8	11	8	
Focal infection	2	2		1	1	1		1	
Toxic amblyopia	10	10		8	2		5	5	
Leber's disease	2	2		1	1	2			
Intracranial aneurysm	1	1		1				1	
Scattering	14	13	1	6	8	5	5	3	1
Undetermined	22	21	1	13	9	1	14	6	1
Total	150	142	8	87	63	22	67	52	9
Percentage		94.7	5.3	58	42	14.7	44.7	34.6	6.0
Percentage of total population in above age groups						18.3	29.43	17.45	5.4

there an abnormal colloidal mastic curve. In these cases it resembled the paretic type. All of the patients with retrobulbar neuritis except one were under 50 years of age, and most of them were much younger (see table 4). Even this small group, it was observed, followed the usual distribution as to sex of 3 to 2, males to females. One patient of this group had a slight blurring of the nerve head, vision of 20/40 in both eyes, and visual fields which, while variable, showed homonymous hemianopia (O.S.) at one time. The diagnostic survey was completely negative and before discharge vision improved to 20/20 and the fields became normal. Three years later he returned with vision in the right eye reduced to perception of hand motions at one foot and vision in the left eye of 20/15. A survey of the patient was again negative. Eight months later the vision was 20/30 + 3 in the right eye and 20/15 in the left eye. Examination of the discs showed a temporal pallor more marked in the right eye. This patient undoubtedly had a demyelinizing lesion in the chiasmal region at his first admission. Six patients of this group could be further classified into acute multiple sclerosis and neuromyelitis optica.

There were six patients in whom the optic neuropathy seemed to be due to disease of the posterior sinuses. In all of these patients a careful survey was negative for pathology except as to disease of the posterior nasal sinuses. The three patients with retrobulbar neuritis had extensive infections of the posterior ethmoid and sphenoid cells. Cultures taken from these cells at operation revealed a variety of organisms: Staphylococcus aureus and albus, Pneumococcus, B. pyocyaneus, and B. influenzae. Pathological examination of material removed from these patients showed chronic sinusitis and polypoid mucous membrane. A short time after operation all of these cases showed definite improvement in vision. The other three patients had definite chronic infection of the posterior sinuses. Two of these showed secondary atrophy and the other, optic neuritis. These patients were demonstrated to have sufficient inflammation of the posterior nasal sinuses to account for the neuropathy. Careful examination revealed no other etiological factor and two of the patients were definitely old for multiple sclerosis. However, in the younger patients it is impossible entirely to eliminate the possibility of multiple sclerosis by one series of observations; such patients must be followed for years before this can be entirely excluded. Although at the present time opinion has shifted from posterior-sinus disease to multiple sclerosis as the major cause of retrobulbar neuritis, it seems that there remains a small group of cases in which disease of the posterior sinuses must be considered an etiologic factor. These six patients are placed in the posterior-sinus-disease classification in view of the definite findings at the present time. However, we are fully aware that subsequent developments in these patients may necessitate their removal from this group.

Focal infection: There were two patients in whom focal infection was thought to be the etiologic factor. In one of these the survey was entirely negative except for bronchiectasis and chronic tonsillitis. In this case it was felt that the retrobulbar neuritis was toxic in character, resulting from the bronchiectasis. The other patient developed retrobulbar neuritis after an attack of pharyngitis. At the time of the pharyngitis the cervical glands were markedly enlarged on both sides. Complete survey in this case was negative except for two periapically infected teeth. It is, of course, possible that this patient will later show definite signs of multiple sclerosis, as it is well known that this latter condition commonly mani-

fests itself after upper-respiratory infections or attacks of influenza.

Toxic amblyopia: There were 10 cases in this group. Seven of these were typical of tobacco-alcohol amblyopia with the characteristic scotoma and definite history of excessive use of tobacco and alcohol. Four had retrobulbar neuritis, while the other three showed papillomacular-bundle atrophy. One of these patients had cirrhosis of the liver and another showed, in addition to his retrobulbar neuritis, peripheral alcohol neuritis elsewhere.

Of the remaining cases in this group one had secondary optic atrophy with marked contraction of visual fields and pigment disturbance of the retina resulting from large doses of quinine given years previously. This patient received 300 to 400 grains of quinine hypodermically within a week for malaria. Following this, there was sudden loss of vision with gradual return about six weeks later.

There was one case of primary atrophy most marked in the papillomacular bundle, due to thallium poisoning. (This patient has already been reported by W. I. Lillie and H. L. Parker.[4]) She had used "Koremlu," a depilatory cream containing 7-percent thallium acetate.

The third case has also been reported. This case of acute reaction to tryparsamide was included in the group reported by Sloan and Woods.[5] The patient was admitted to the hospital following rather sudden loss of vision 48 hours after receiving 3.0 grams of tryparsamide, the only injection of the drug that the patient had received. Before treatment was started vision was 20/15 in both eyes, and the visual fields were normal. Seventy-two hours after receiving the tryparsamide the vision was reduced to perception of hand motions at three feet. The patient was admitted to the hospital for forced cerebrospinal-fluid drainage. Analysis of the first spinal fluid obtained revealed a trace of arsenic. At the onset of visual failure the picture was that of retrobulbar neuritis. Central scotoma was demonstrated at one time during improvement in vision. Definite pallor of the discs, more marked in the papillomacular bundle, appeared after about five weeks. Vision gradually improved and seven months later was 20/20.

Leber's disease: There were two cases of Leber's disease, which presented the clinical picture of papillomacular-bundle atrophy. These cases are particularly interesting in that one patient was a young woman. It has now been definitely established by Julia Bell[6] and others that a small percentage of these cases are seen in females. This patient's mother gave the history of visual failure at the age of 26 years. It was later learned that a male cousin of this patient had been diagnosed elsewhere as having Leber's disease.

Miscellaneous: There were 14 isolated cases in this group. In one case the clinical picture was that of a secondary optic atrophy in one eye and papilledema in the other. Exploratory craniotomy revealed an aneurysm of the anterior communicating cerebral artery indenting the optic nerves in front of the chiasm. Three cases were due to orbital conditions. One case of secondary atrophy resulted from hemangioma of the orbit; one of papilledema caused by a dural endothelioma of the optic-nerve sheath; and one of papilledema due to low-grade orbital cellulitis, secondary to an ethmoid infection. Two optic neuropathies followed encephalitis: one showed secondary atrophy and the other papillomacular-bundle atrophy. One case presenting primary optic atrophy was in a luetic patient in whom visual failure came on suddenly with a subarachnoid hemorrhage that followed a spinal tap. There was one case of sec-

ondary atrophy resulting from a rather long exposure to an electric welding arc. Another case with secondary atrophy was seen in a patient with Paget's disease. X-ray examination of the head showed sclerosis in the region of the optic foramina on the affected side. Secondary atrophy was also seen in a patient who showed the condition often called polyneuritis cranialis. This case exhibited peripheral lesions of the sixth and seventh nerves on one side in addition to bilateral involvement of the optic nerves. There was a case of optic neuritis, which was considered to be secondary to the general toxemia and hyperpyrexia of pyelitis. A case of optic neuritis possibly due to trichlorethylene is being studied still further and will be reported by another member of the staff. There was a case of choked disc due to stenosis of the aqueduct of Sylvius. The last case in this group was of choked disc caused by a giant-cell tumor of the skull.

Undetermined: There were 22 patients in whom the etiology could not be determined. In four of these multiple sclerosis was suspected but as the diagnosis could not be definitely made they were classified as undetermined cases until that diagnosis could be substantiated. The posterior sinuses were opened in two cases without finding enough pathology to establish the diagnosis. In one patient X-ray examination of the skull revealed some hyperostosis of the inner table of the frontal bone; the remainder of the skull was within normal limits. Although impaired vision has been reported in some patients with this condition by S. Moore[7] we did not feel justified in explaining this optic neuropathy on this basis. In the remainder of the cases exhaustive diagnostic studies failed to reveal the etiology of the optic neuropathy.

TABLE 5

ETIOLOGIC FACTORS IN ALL THREE STUDIES AND COMBINED TOTAL

		Brain Tumor	Pseudo Tumor	Syphilis		Arterio-sclerosis		Posterior Sinus Disease	Multiple Sclerosis	Focal Infection	Toxic Amblyopia	Leber's Disease	Mental Retardation	Intracranial Aneurysm	Scattering	Undetermined
				Central Nervous System	Secondary	Occlusion Central Artery	Endarteritis Nutrient Vessels									
Woods and Dunn 86 Cases (Ambulatory)	Number of cases	10		35				11	5		10				3	12
	Percentage	11.6		40				12.7	5.8		11.6				3.5	13.8
Woods and Rowland 137 Cases (Admitted to Hospital)	Number of cases	38	7	22	1	6	9	11	9	4	6	2	2	2	7	11
	Percentage	27.7	5.1	16.0	0.7	4.3	6.6	8.1	6.5	2.9	4.4	1.5	1.5	1.5	5.1	8.1
Present Series 150 Cases (Admitted to Hospital)	Number of cases	23	5	26	3	2	7	6	27	2	10	2		1	14	22
	Percentage	15.3	3.3	17.3	2.0	1.3	4.6	4.0	18.0	1.3	6.6	1.3		.66	10.0	14.6
Combined Total 373 Cases	Number of cases	71	12	83	4	8	16	28	41	6	26	4	2	3	24	45
	Percentage	19.0	3.2	22.2	1.1	2.2	4.3	7.5	11.0	1.6	7.0	1.1	.5	.8	6.4	12.0

COMMENT

The results of the preceding etiologic studies of the optic neuropathies reported from the Wilmer Ophthalmological Institute are shown in table 5. With the exception of the multiple sclerosis-posterior-sinus group the present study closely parallels the study of Woods and Rowland. This table also gives percentages of

the various etiologic factors obtained by combining the results of all three of the reports.

As in the previous report of cases that had been admitted to the hospital, the results show a smaller proportion of patients with optic neuropathies due to syphilis than is actually the case. The series of Woods and Dunn which comprise ambulatory patients had over twice the percentage of cases in which syphilis was the etiologic factor. The only patients of this group admitted to the hospital were those in whom acute loss of vision demanded special treatment that could not be carried out in the clinic. The figures in the remaining groups, particularly the retrobulbar-neuritis—papillomacular-bundle-atrophy syndrome, are probably a fairly accurate reflection of the actual conditions.

Summary

A series of 150 patients presenting optic neuropathies, who had been admitted to the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital, is studied. Of these cases 15.3 percent were due to intracranial tumor; 3.3 to pseudotumor; 19.3 to syphilis; 5.9 to arteriosclerosis; 4.0 to posterior-sinus disease; 18.0 to multiple sclerosis; 1.3 to focal infection; 6.6 to toxic amblyopia; 1.3 to Leber's disease; 0.66 to intracranial aneurysm; 10.0 to miscellaneous conditions; while in 14.6 percent the exact etiologic factors could not be determined.

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STUDIES ON GALACTOSE CATARACT*

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Until recently the experimental study of the factors influencing cataract has been hindered by the inability to produce cataract consistently and rapidly. For example, senile cataract as well as that in diabetes and tetany is slow and inconsistent. Naphthalene cataract in rabbits is likewise uncertain, some rabbits showing an unusually high resistance. Radiational cataract does not usually appear before six months and may take three years to develop. Traumatic cataract is of limited value, since the conditions attending its formation are entirely different from those present in senile cataract. With the discovery by Mitchell and Dodge[1] and Yudkin and Arnold[2] that lactose and galactose produce cataract in rats, a tool was given to the experimental ophthalmologist for the study of factors concerned in its formation. We have found that the feeding of galactose produces cataract in young rats consistently and in uniform time. Young rats between six and eight weeks old, weighing 65 to 80 grams, when placed on a 50-percent galactose diet, develop peripheral opacities on the third day that gradually spread centrally and produce a complete superficial opacity on the ninth to eleventh day, and a mature white cataract between the twenty-fourth and thirtieth days. Older rats, six months and over, are more resistant and do not show opacities for a much longer period of time. An explanation for this difference is offered later in this report.

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THE EFFECT OF GALACTOSE ON THE EYE

Experiment 1: The purpose of this experiment was to determine whether animals other than rats are affected by galactose. The right eyes of two adult rabbits were enucleated and the glutathione content of the lenses was determined. The animals were then given 30 grams of galactose daily by means of a stomach tube. The left eye of Rabbit 1 was removed on the third day and that of Rabbit 2 on the ninth day, and the glutathione content of the lenses was determined. The results showed a marked decline in sulphydryls as compared with the controls.

TABLE 1

GLUTATHIONE IN THE LENSES BEFORE AND AFTER THE FEEDING OF GALACTOSE

	Before mg. %	After mg. %
Rabbit 1	403	297 (3 days)
Rabbit 2	383	186 (9 days)

Bellows[3] has proved that galactose when fed to rats produces a decrease in the glutathione content of the lenses before the opacities appear. It is reasonable to believe that a drop in the glutathione content in the lenses of rabbits when fed galactose indicates that the same mechanism is operative in these animals. Although the experiment was not carried on long enough to produce cataracts in these animals, it would seem that the formation of galactose cataract is not restricted to the rat. However, the large amount required to produce this condition in larger animals might be prohibitive, because of the cost of galactose.

Experiment 2: This experiment was

undertaken to determine whether the sugar content of the aqueous humor is increased upon the administration of galactose. Two adult rabbits and one dog were used. The aqueous of the right eyes of these animals was aspirated and the sugar content determined and used as a control. Galactose was injected intravenously, the amount varying with the size of the animal, and after 30 minutes to one hour the aqueous was removed from the left eye and the amount of sugar determined.

TABLE 2

AMOUNT OF REDUCING SUGAR IN THE AQUEOUS HUMOR

	Control Right Eye mg. %	Amount of Galactose Injected	Time Elapsing before Left Aqueous was Removed	Left Eye mg. %
Rabbit 1	111	4 grams	1 hour	384
Rabbit 2	135	6 grams	30 minutes	454
Dog	93	20 grams	1 hour	251
(Blood Sugar)	77			131

We conclude from this experiment that, following an intravenous injection of galactose, there is a sharp rise in the amount of reducing sugar in the aqueous humor within one-half hour. This result argues that the sugar is probably galactose, because the liver obviously could not convert this sugar into glucose in so short a time. However, we could not produce the typical crystals of galactosozone from the sugar in the aqueous, owing to its small amount and the presence of interfering substances.

It was thought that it would be interesting to see if the local injection of galactose into the anterior chamber would cause any change in the crystalline lens. Therefore, the aqueous humor of a rabbit's eye was aspirated daily and an equal amount of 5-percent galactose, osmotically equal to the aqueous humor, was injected for a period of seven days. At the end of this time there was neither any visible change in the lens nor a diminution of glutathione as compared with that of the control eye. It appears from this experiment that galactose produces a change in the crystalline lens because of systemic changes rather than as the result of a local disturbance. A criticism of this experiment is that in feeding galactose there is probably a more uniform and prolonged increase in the sugar content in the aqueous humor and therefore a greater effect upon the lens could be expected than from a single daily injection. A local effect is, therefore, not disproved.

STUDIES ON THE OXIDATION-REDUCTION POTENTIAL OF GALACTOSE CATARACT

It was thought that an investigation of the oxidation-reduction potential of the lens might throw some light upon the mechanism of galactose cataract. The broad interpretation of oxidation and reduction is used here. Oxidation is the process in which a substance loses electrons, and reduction is the process in which a substance takes on electrons. The principle underlying oxidation-reduction potential is that a solution containing both an oxidized and a reduced form of a substance sets up an electrical potential at an inert electrode. Reducing ions tend to make an inert electrode more negative, and oxidizing ions tend to make it more positive. When ferrous ions collide with a platinum wire, for example, they tend to give up electrons to the elec-

trode and make it negative while the ferrous ions themselves become oxidized to ferric ions. The converse is true of the ferric ions. They tend to take electrons from the electrode to form ferrous ions and leave the electrode positively charged. The potential is characteristic of the system measured and depends upon the ratio of reduced to oxidized form as well as pH and temperature. Knowledge of the characteristic potential of a system gives information as to its relative oxidizing or reducing ability. The lens readily lends itself to such a study, since it resembles a pure tissue culture.

The apparatus used for the determination of oxidation-reduction potential consisted of a gold electrode and a saturated calomel half cell. The potentials obtained were read on a potentiometer.

Experiment 3: The right eyes of eight young rats and five old ones were enucleated and the oxidation-reduction potential of each lens was determined. Readings were taken from both the cortical and nuclear portions of the lenses. The animals were then placed on a 50-percent galactose diet for 10 days and the same procedure was applied to the left eye.

The results obtained are shown in table 3. Omitting the potential of +84 mv. found in the cortex of rat 1, a value decidedly at variance with the others, the average potential in the cortex of the lens in young rats is +19 mv. This value is not at great variance with the average of those found in the cortex of older rats, +7 mv. After 10 days of galactose feeding the average potential of both groups rose to +54 and +42 mv., respectively.

The values of the oxidation-reduction potentials in the nucleus, however, present a more marked change. There was a great deal of variation in the potentials of the center of the crystalline lenses of young rats ranging from —13 to +117 mv., and averaging +40 mv. In the older rats the potential of the nuclear portion of the lens was fairly constant, ranging from +119 to +150 mv. and averaging

TABLE 3

THE OXIDATION-REDUCTION POTENTIALS IN MILLIVOLTS

Rat Number	Cortex		Nucleus	
	Before Galactose	After Galactose	Before Galactose	After Galactose
YOUNG RATS, WEIGHT 45 GRAMS, 6 WEEKS OLD				
1	+84	+48	+ 20	+136
2	+18	+68	− 3	+153
3	+ 7	+36	+117	+160
4	+ 6	+79	+112	+150
5	0	+ 7	− 12	+145
6	+36	+69	− 1	+150
7	+39	+73	− 13	+153
8	+30		+102	+152
Average	+28	+54	+ 40	+150
OLD RATS, WEIGHT 190 GRAMS, 1 YEAR OLD				
1	− 4	+45	+123	+147
2	+21	+60	+136	+154
3	−18	+32	+150	+158
4	+14	+32	+131	+158
5	+24	+41	+119	+148
Average	+ 7	+42	+132	+153

+132 mv. After the period of galactose feeding, the potential rose markedly in the center of the lenses in the young rats, readings ranging from +136 to +160 mv. and averaging +150 mv. There was a much smaller rise in the potential of the nuclei of the older rats, the average rising to +153 mv.

Discussion: It is known that a higher metabolic rate exists in the cortex of the lens than in its hard nucleus, such as is found in old rats. Our observations show that the potential in the hard nucleus is decidedly more positive than in the cortex. A correlation can therefore be drawn between the potential and the metabolic activity, a lower potential accompanying a higher metabolic rate. This metabolic activity depends upon the presence of oxidation-reduction systems, which give a negative trend to the potential. Their loss is indicated by a rise in the potential. Accepting this hypothesis, it is observed that the cortices of both young and old rat lenses are similar in metabolic activity and that they both respond in the same manner to galactose feeding. This is in harmony with our findings that glutathione is markedly diminished in the lens upon galactose feeding.

From our results it may be said that in general the potential of the center of the lens of very young rats is approximately the same as that of the periphery. It indicates that the metabolic activity of the young lens is equal in rate throughout. This agrees with the histological findings that nearly all the lenticular fibers in the young animal are nucleated, while in the old animal only the peripheral fibers contain nuclei. However, after galactose feeding, the potential of the center of the lens of the young rats rises to an average value approximating that found in the center of the senile lens. Thus, galactose seems to have an effect similar to the process of aging, both producing a rise in the potential of the lens nucleus. Our results differ from the oxidation-reduction potentials of normal and cataractous lenses obtained by Nordmann.[4] This author used a platinum electrode. We believe our results are more accurate, for it has been repeatedly shown that in the presence of glutathione a platinum electrode gives false values. Nordmann's findings in normal and cataractous lenses show higher positive values than ours. However, we confirm his observation that the potential of the lens becomes more positive as it undergoes opacification.

The effect of vitamin-C deficiency and galactose upon the crystalline lens

Whether the deficiency of vitamin C has any significance in the etiology of cataract has been a matter of dispute. Van Euler and Malmberg[5] found that on a vitamin-C-deficiency diet the concentration of this substance in the crystalline lens fell in guinea pigs. Johnson[6] also found the vitamin-C content of the lens in the guinea pig to parallel the loss of that of the other body tissues in scurvy. In the cataractous lens Van Euler and Martius[7] found ascorbic acid to be greatly diminished or absent. Monjukowa and Fradkin[8] were able to produce cataract in a small percentage of guinea pigs by feeding them a scorbutic diet, and if the aqueous was drained by paracentesis, cataract developed in all the animals. Bellows, in a study of galactose cataract in rats, found that administration of vitamin C retarded the onset of opacities, although its action in this respect was not so marked as that of cystine. Bellows[9] also conducted a clinical study of the blood level of vitamin C in cataractous patients and found the average level to be definitely lower than that in normal individuals.

Against this evidence of the importance of vitamin C in the economy of the lens, is the fact that Johnson could produce

no cataract in guinea pigs, even with complete depletion of vitamin C of the lens. Evans[10] went so far as to state that the indophenol-reducing substance is not vitamin C. This worker found that lens tissue fed at various levels did not protect guinea pigs from scurvy. However, Van Euler and Malmberg repeated this work and found the indophenol-reducing substance to be vitamin C. Birch and Dann[11] were able to confirm the presence of vitamin C in the lens of the ox by biologic tests by the tooth-protection method. Further, Johnson identified vitamin C in the lens by spectographic determinations. Additional proof of the presence of vitamin C in the lens was given by the authors[12] when it was demonstrated that the indophenol-reducing substance was oxidized by a specific vitamin-C oxidase.

It has been proved by Bellows and repeatedly shown by the authors that when galactose is fed to rats there occurs a decrease in glutathione before the onset of opacities. We have also shown this phenomenon to occur in rabbits, making it seem possible that this decrease would occur in all animals. Using this decrease in glutathione as a criterion for oncoming cataracts, the effect of various agents and conditions on the onset of cataract can be studied. We therefore undertook to determine whether a diet, high in galactose, would produce a decrease in the glutathione content of the guinea-pig's lens and whether this decrease would be influenced by a depletion of vitamin C.

Experiment 4: Twenty-four guinea-pigs were divided into four groups of six as follows: group 1 comprized the control animals on a normal diet; group 2 was placed on a scorbutic diet; group 3 was placed on a scorbutic diet containing 35-percent galactose with a daily ration of orange juice; group 4 was on a diet similar to group 3's but without orange juice. After 23 days the lenses were removed and the glutathione and vitamin-C contents were determined. The average results are shown in table 4.

Results. As in rats and rabbits, it is seen from table 4 that galactose produced a loss of glutathione in guinea pigs. This loss was much less in animals given a daily ration of vitamin C in the form of orange juice. Scurvy caused a small but appreciable increase in the glutathione. This confirms a similar observation made by Smaltino.[13] There is a rather sharp loss in the vitamin-C content of the lens in all of the experimental animals on the scorbutic diet, as was expected.

TABLE 4

GLUTATHIONE AND VITAMIN-C CONTENT OF LENSES AFTER DIETS

Diet	Glutathione mg. %	Vitamin C mg. %
Normal	138	27.5
Scorbutic	159	12.9
Normal with galactose	111	20.4
Scorbutic with galactose	75	11.5

Discussion. Because of the nature of the experiment, no lenticular opacities appeared, inasmuch as the duration of the experiment, of necessity, was determined by the rapidity of the onset of scurvy. It is reasonable to assume that since a loss of glutathione precedes the cataract in rats, the same mechanism is operative in the guinea pig. We have observed that scorbutic guinea pigs have a higher lens content of glutathione than the normal animal. Assuming that vitamin C is an essential component of the respiratory mechanism of the lens, it may be deduced that a deficiency of this vitamin causes an increased amount of glutathione by a compensatory reaction. The finding that the loss of glutathione is enhanced in animals deprived of vitamin C while on a galactose diet is in harmony with the observations reviewed previously, showing the importance of vitamin C in the metabolism of the lens. As in the rabbit and

rat, a high galactose diet causes in the guinea pig a decrease in the glutathione concentration of its lens. However, a combination of scurvy and galactose produced a more marked decrease in the glutathione content of the lens than might have been expected from these individual factors operating by themselves. It follows, from these observations, that a vitamin-C depletion, *per se,* does not produce any noticeable change in the lens, but its absence predisposes the lens to a greater degree of susceptibility to agents causing cataract which ordinarily would not affect the normal eye.

Summary

A galactose diet causes a loss of glutathione in the crystalline lens of rats, this loss preceding the lens opacities. A similar decrease of the glutathione concentration in the lens occurs in the guinea pig and rabbit placed on a galactose diet. Since glutathione is diminished in the senile lens and decreased or absent in all forms of cataract, this loss is significant. Another parallel that can be drawn between senility and the effect of galactose on the lens is a rise in the potential that takes place in both conditions. Cystine and vitamin C exert a retarding influence upon the onset and progress of galactose cataract. Scurvy in itself causes an increase in the glutathione concentration in the lens of the guinea pig, whereas when superimposed upon a high galactose diet, there occurs a greater loss of glutathione, than that produced by a galactose diet alone.

Appreciation is expressed for the kindly suggestions and criticisms of Professors S. R. Gifford and C. J. Farmer.

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Discussion

Answer to Dr. Yudkin's question: We noticed in another experiment that rats fed on a galactose diet containing 10-percent yeast did not develop cataract so readily as control animals. In order to determine whether this was due to the sulphydryl content or some other factor in the yeast, we repeated the experiment using cysteine hydrochloride instead of yeast. We found this substance to have a retarding effect upon the appearance of the cataract. A similar but less marked effect was produced by ascorbic acid (Merck). The dosage of the cysteine was up to 2 percent of the diet.

THE PRODUCTION AND CURE OF OCULAR DISTURBANCES IN ADULT ALBINO RATS BY ADJUSTMENT OF VITAMIN A*

CLINICAL IMPLICATIONS

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Much, if not all, of the previous work on vitamin A has been carried out with young animals. This has occurred partly because of the supposed greater susceptibility of younger animals and partly for economic reasons. Since vitamin A, when fed in abundance, is readily stored in the animal body, it has been necessary to conduct experiments on young animals, when storage is at a minimum, in order to bring about the deficiency within a reasonable length of time. Consequently, it has not been determined whether the familiar ocular changes seen in the young rat suffering from acute vitamin-A deficiency, occur in the adult animal under the same circumstances.

In the present experimental study, it was observed that normal-appearing adult rats which had been reared to middle age (315 days of age) on an adequate diet supplying, however, only the smallest amount of vitamin A that would permit normal growth and prevent the appearance of any symptoms of vitamin-A deficiency, rapidly developed the deficiency when the vitamin A was entirely removed.

The first signs of ocular disturbance in both the young and the adult animal was lacrimation and photophobia; then the normally protruding eyeballs receded, producing an enophthalmos. The lacrimal secretion within a few days changed to a viscid, then to a serosanguinous discharge which adhered to the eyelids and frequently matted them together. In the meantime the eyeball became slightly congested and the cul-de-sac filled with broken-down cellular material. When this stage was reached the cornea became hazy and lusterless, and often a plaque formed on the exposed cornea (palpebral fissure). In the adult animal deprived of vitamin A an herpetic eruption of the cornea seemed to be the more prevalent lesion. This could not be brushed off the tissue, as was possible with the plaque. This stage was considered to be an advanced condition, and some of the animals were given cod-liver oil for curative purposes; others were killed for pathological study. The ocular lesion produced in the older animal was more destructive than that observed in the younger animal.

The type of gross pathological manifestation produced in the adult animal simulated very closely the classical picture repeatedly observed in vitamin-A deficiency in the young animals.

Control animals, however, from whose diet the vitamin A was not removed at any time, showed no evidence of ocular changes. A second control group was fed the same diet, which, however, was supplemented by a comparatively large amount of vitamin A until the animals reached middle age (315 days), when they too were deprived of the vitamin. In contrast to those rats which received a small but adequate quantity of vitamin A during the preliminary period, these animals failed to develop any ocular changes or, in fact, any symptoms of the deficiency.

From these results it would appear that

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when the entire source of vitamin A is removed, an adult animal which has little or no store of vitamin A is fully as susceptible to the deficiency as is a young rat with its low reserve of the vitamin. In other words, a circumstance that brings about an inadequate intake or absorption of the vitamin may cause the development of symptoms of the deficiency in the adult animal provided the former supply, even though adequate at the time, was insufficient to build up a satisfactory reserve.

It is fairly well agreed that in vitamin-A deficiency the outstanding change is a substitution of stratified keratinizing epithelium for normal epithelium in various parts of the respiratory, alimentary, and genito-urinary tracts and in the ocular tissues. In both the young and adult animals there is evidence of poor staining of the superficial layers of the cornea; in the early stages, the basal layer is still preserved and well stained. A cellular exudative reaction appears below this layer. Frequently a break in the continuity of the basal layer is followed by reparative proliferation of the cells. The basal cells may respond by active mitotic division. The invaded area below the basal cells show a predominence of polymorphonuclear lymphocytes. There is a polymorphonuclear infiltration of the epithelium above and of the substantia propria below. The substantia propria becomes increasingly thicker because of the cellular reaction and the accumulation of edema. New blood vessels are formed. As the inflammation progresses the epithelial layer of the cornea stains very poorly and finally sloughs off in a limited zone with the production of a superficial ulcer. The spindle-shaped cells of the substantia propria are fewer in number and the interstitial layer has a frayed appearance; it stains more eosinophilic than normal. There is also a tendency for reparative processes to take place. There appear large mononuclear phagocytic cells of the endothelial leucocytic variety. The cells that previously formed the inflammatory process now have pyknotic and karyorrhexic nuclei. It appears that the function of the phagocytic cells is to remove the debris.

When the eyes of some of the adult experimental animals were in this condition, vitamin A was fed to cure the deficiency disease. A histologic study of the ocular tissue of the cured animals is exceedingly instructive. The healing progresses gradually. The increased vascularity, which first appeared during the acute inflammatory process, begins to decrease. There remain ultimately only a few blood vessels in the substantia propria. The fibroblasts increase in number and lead to a thickened substantia propria. There is an occasional mononuclear cell filled with phagocytosed yellowish pigment. The basal-cell layer of the epithelium in the final stages of repair no longer forms the sharp line of demarcation but is rather piled up in an irregular manner, simulating the "rete pegs" of the skin. There is hyperkeratosis of the corneal epithelium, which again no longer permits a smooth corneal surface. Among the proliferated epithelial cells of the cornea can be found occasional mitotic figures. In some instances the process has subsided with a complete restitution to normal of the corneal structures and it is impossible to distinguish the healed cornea from one that had not previously been involved.

Outspoken vitamin-A deficiency in man appears to have been somewhat more common in Europe than in this country. Nevertheless, recent studies in this country would seem to indicate a surprising prevalence of subclinical vitamin-A deficiency, particularly among children. These observations have depended upon instruments supposedly measuring dark adaptation. As yet there has not been established a norm on which variations in

dark adaptation can be estimated. Clinical experience leads us to believe that there are several factors that may influence dark adaptation; for instance, true light-complexioned individuals have a different norm from that of the dark-complexioned individuals; prolonged dark adaptation is present in a variety of diseases; for example, retinitis pigmentosa, retinitis albescens, and choroideremia.

Under ordinary conditions it appears that the American dietary is reasonably adequate. It should be kept in mind, however, that the absorption of the various dietary constituents is dependent upon satisfactory gastro-intestinal function. Inasmuch as circumstances of modern life may interfere with proper digestion, an individual may conceivably suffer from an incipient lack of any one of the indispensable food factors, despite the fact that plenty is consumed in the food.

The ophthalmologist sees a group of patients with ocular disturbances presenting no obvious other clinical abnormalities, the individuals of which, however, on careful questioning, offer bits of evidence which in the light of the newer knowledge of nutrition point toward a greater or less degree of nutritional deficiency. Although the condition of acute, uncomplicated, vitamin-A deficiency, such as can be produced in young and adult rats, is rarely seen in private or clinical practice, a type of keratitis in adults amenable to vitamin therapy is encountered.

Within the last four years 16 cases of keratitis, in which the etiology was not obvious, have been observed. A thorough physical examination revealed no signs nor manifestations of infection. The histories of the patients indicated that the condition was accompanied by loss of appetite, constipation, headache, and general malaise. Invariably these patients had lost their teeth early in adult life. The patients' ages ranged from 45 to 68 years. The first complaint was that of having something in the eye and photophobia. The cornea appeared normal at first, nevertheless the eye was very painful. The patients noted no visible ocular disturbance. When the eye was examined, there was seen a breaking down of the periphery of the portion of the cornea that was exposed in the palpebral fissure or in the area covered by the lower lid. Very little, if any, congestion was present. The cornea often stained with fluorescein. The lesion did not seem to improve with local treatment and within a few days the ulcer appeared to be more extensive. The invaded cornea presented a shallow, excavated ulceration which frequently spread along the margin of the cornea and extended toward the pupillary area. An examination of this area with the slitlamp revealed a swollen, edematous corneal epithelium and a similar involvement of the substantia propria. The surrounding tissue showed considerable vascularity. The corneal nerve fibers extending into the diseased area were very prominent.

In this type of corneal lesion, particularly in the early stages, no definite inflammation of the deeper layers of the cornea and uveal tract could be detected. Often the lesion was described as a catarrhal ulcer, without any definite inflammation of the conjunctiva. In some instances the ulceration had the appearance of a lesion of the cornea produced by an injury, but no history of injury could be elicited. Frequently, when first seen, the corneal lesion resembled that of marginal ulcer, indolent ulcer, or rodent ulcer. At this stage the aqueous humor revealed numerous floaters and Descemet's membrane was sometimes even studded with deposits. The uvea often was involved at this stage.

The treatment of this type of corneal lesion has been very unsatisfactory. Local medication and heat seemed to aggra-

vate and delay the healing process, producing a refractory condition. It was frequently necessary to cauterize the cornea with full-strength tincture of iodine or phenol. In this stage the cornea often became infected and produced a hypopyon ulcer, necessitating more drastic treatment.

It was suggested from experience in the laboratory with animals on deficiency diseases that this condition might be a nutritional disturbance; therefore a number of these patients were given cod-liver oil in addition to their regular diet. Some showed improvement in a short period of time, whereas others did not respond. It was evident that some other factor was involved. From the history of the case it appeared that the intestinal tract might be at fault. These patients were given large quantities of vitamin-B complex before each meal in addition to the cod-liver oil. In a large proportion of these cases, the systemic and ocular disturbances disappeared.

In spite of the fact that certain ocular lesions in animals have been shown to be due to a deficiency of vitamin A, we are not yet warranted in assuming the same course for somewhat similar lesions in man. For example, some ulcers of the cornea may not respond to vitamin A alone, but will respond when vitamin-B complex is administered. Again, undoubtedly many corneal lesions have an etiology entirely apart from nutritional deficiency. The main object of this paper is to emphasize the part which malnutrition may sometimes play in the production of ocular pathology, a fact which perhaps has not been sufficiently stressed.

Discussion

Dr. Conrad Berens: May I ask if you think cod-liver oil is the best preparation to use in those cases?

Dr. Yudkin: I prefer a standard brand of cod-liver oil for the treatment of this type of ocular disturbance. Cod-liver oil concentrates and carotene are used by many clinicians. I believe that there is something in cod-liver oil besides vitamin A that aids in repairing the diseased tissue. Frequently cod-liver oil taken internally does not clear up the ocular disturbance. It is my impression that the cod-liver oil is not absorbed properly by the intestinal tract. I therefore prescribe vitamin-B complex as a supplement, for it seems to help the intestinal tract to function normally. I ordinarily use a standard brand of brewer's yeast for this purpose. From our clinical experience it is evident that vitamins alone will not repair the damaged tissue unless the patient is also given a well-balanced diet, not a fanatic diet, but one which every trained medical practitioner can very easily formulate.

Dr. Verhoff: You stated that ulcers definitely belong in this group. You must mean Mooren's ulcer and I would like to know whether you ever cured Mooren's ulcer by this treatment.

Dr. Yudkin: I have had very little personal experience with Mooren's ulcer, but from an interpretation of the literature the rodent lesion may belong to this group that I have described.

Dr. Berens: You said you applied the cod-liver oil locally?

Dr. Yudkin: No, not locally.

Dr. Berens: Would you be willing to express an opinion in regard to that form of therapy?

Dr. Yudkin: Cod-liver oil has been used locally in ocular therapy. I have no personal experience with its application. It is my impression that it will irritate the conjunctiva when so used. Cod-liver oil ointment is advocated for ulcers of the skin.

Dr. Berens: Is there no experimental work on that?

Dr. Yudkin: I have no knowledge of any experimental work. However, some years ago, I received a circular from a pharmacist in Philadelphia who was dispensing cod-liver oil in the form of a salve to several oculists.

NEUROMYELITIS OPTICA*

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Changes in the optic nerves associated with various types of lesions of the spinal cord were described in 1870 by Allbutt,[1] but Erb,[2] in 1879, was the first to report a case of myelitis accompanied by optic neuritis. The pathology of this syndrome was described by Achard and Guinon in 1889.[3] Devic, in 1894, summarized all the previous reports of the condition which he called neuromyelite optique aiguë, and added a case of his own.[4] Although mainly known by this name, the disease has also been described as neuropticomyelitis, ophthalmoneuromyelitis, diffuse myelitis with optic neuritis, acute disseminated myelitis, and so forth. In this country the first observations were reported by Seguin in 1880[5] and by Noyes in 1881.[6] According to Beck,[7] 70 cases had been reported up to 1927, and approximately 50 cases have been added since that time.

Clinically the disease is characterized by loss of vision, due to an acute retrobulbar type of optic neuritis, and paraplegia, due to diffuse myelitis. The visual symptoms are characterized in the early stage by an acute loss of central vision and by orbital pain that is accentuated by movements of the eyes or pressure on the globe. The pupils are dilated and react to light to a degree dependent upon the amount of visual loss. At the onset the nerve head is normal or slightly edematous and there may be varying degrees of central scotoma. The involvement is usually monocular at first, but is followed in a few days or weeks by a similar process in the fellow eye. As the disease advances, an acute optic neuritis develops which is often accompanied by hemorrhages and exudates in the central portion of the fundus. The central scotoma increases in size, so that within a few days the vision is entirely lost. Improvement in vision occurs in 50 to 60 percent of the cases, peripheral light perception returning first. The progress is slow; complete restoration is rare. Early in the course of the optic neuritis the disc may become infiltrated and, as the edema subsides, a partial or complete secondary optic atrophy remains. Elschnig[8] stated that the prognosis for vision is better if the change in the color of the disc is only slight in the early stage.

The myelitis may become evident before or after the onset of the optic neuritis. In Beck's series the myelitis preceded the ocular symptoms in 36 cases, the blindness occurred first in 18, in 10 the symptoms came on simultaneously, and in four there were no symptoms referable to the eyes, but the neuritis was discovered during the course of the examination.[7] On the other hand, Goulden stated that loss of vision was the primary symptom in 80 percent of the cases.[9] The myelitis may be of a transverse,[10] diffuse,[11] or ascending[12] type, and is usually first manifested by unilateral involvement of the lower extremities with spastic paralysis, ataxia, and loss of sensation. The reflexes are usually exaggerated, but occasionally they are lost.[13] There may also be paralysis of the sphincters and of respiration.

Pathologically the condition is characterized by scattered areas of complete demyelinization and axis-cylinder destruction with marked proliferation of microglia elements, lymphocytes, and plasma cells. The lesions predominate in the spinal cord and the optic nerves and

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tracts, but in some instances there are also scattered lesions throughout the white matter of the brain.[14] In most cases the lesions tend to be continuous, but less frequently they are disseminated. Some authors assume that the lesions at first are perivascular and later extend and coalesce.[15] The condition shows some resemblance to, but can be definitely differentiated, both clinically and pathologically, from multiple sclerosis, disseminated encephalomyelitis, and diffuse sclerosis. In multiple sclerosis the rarefaction and destruction of the myelin sheaths and axis cylinders is less severe than in neuromyelitis optica. In disseminated encephalomyelitis the lesions are discrete and usually do not coalesce. There is some resemblance between the demyelinization seen in diffuse sclerosis of the Schilder's type and neuromyelitis optica, but in the latter the process is more acute and is definitely localized to certain parts of the nervous system.

The etiology of neuromyelitis optica is not known. The presence of focal or slight systemic infections in many cases suggests an infectious or bacterio-toxic origin.[16] However, attempts to isolate an organism or ultravirus as the etiologic agent have been unsuccessful. Some observers have considered the disease as a form of disseminated encephalomyelitis or acute multiple sclerosis.[17] Syphilis, alcohol, nephritis, and epidemic encephalitis have been suggested as the etiologic factors.[18] Although a definite infectious basis has not been established, this origin seems to be the most likely.

As a rule the diagnosis is not difficult, but it must be borne in mind that the optic neuritis and the myelitis rarely become evident simultaneously; the onset of one may follow the other after an interval of several months. The disease may develop at any age. Remissions and relapses are not uncommon in neuromyelitis optica, especially in the early stages of the disease, and recurrences have been reported after several months. There may be a close resemblance between the symptoms seen in neuromyelitis optica and those of multiple sclerosis; however, in the latter condition a definite optic neuritis is rare, the difficulty in vision usually being due to a retrobulbar neuritis. An acute onset of symptoms is rare in multiple sclerosis, and remissions and relapses are more frequent. In disseminated encephalomyelitis there may be similar symptoms, but the condition usually results in recovery. Neuromyelitis optica may also be confused with tumor of the brain; however, the loss of vision caused by papilledema in tumors is much less rapid. The differential diagnosis between neuromyelitis optica and syphilis of the nervous system, epidemic encephalitis, and poliomyelitis is usually not difficult.

The examination of the cerebrospinal fluid is of importance. There may be some increase in the protein content, and often a nonspecific change in the colloidal gold curve. Usually there is no increase in cells, but a mild pleocytosis, either lymphocytic or polymorphonuclear, has occasionally been reported.[19] There is no increase in pressure.

The duration of the disease varies greatly. The rapidity of the onset of the symptoms or their chronicity do not necessarily influence the prognosis, which, on the whole, is doubtful. Some cases result in death within a few days, and others progress to almost complete recovery, both as to vision and paralysis. In most of the cases that do not terminate fatally the symptoms fluctuate, finally terminating in residual paralysis of varying degree or secondary optic atrophy. Various observers have estimated the mortality at approximately 50 percent.[20] Therapeutic means, thus far, have proved unsatisfactory; arsphenamine, mercury, iodides, salicylates, quinine, and even hyperpyrexia having been tried unsuccessfully.

REPORT OF CASE

R. A. W., an attorney, aged 31 years, was referred to the University Hospital on September 8, 1936, by Dr. Raymond D. Sleight of Battle Creek, Michigan. Two weeks before admission he had noticed deep pain in both orbits, especially on moving the eyes, so that he tended to move the head rather than the eyes in looking from side to side. The past history was without significance. A very slight head cold was present at the time of the onset of the symptoms. Nine days before admission the pain in the eyes became more marked and there was rapid loss of central vision in the right eye. The next day there was blurring, followed by failing central vision in the left eye. In a few days the patient could see only moving objects peripherally with the right eye and large objects peripherally with the left. The bilateral central scotomas extended to about the 40-degree meridian. At the time of admission there was complete blindness of the right eye; but with the left, moving objects could be seen peripherally. There had been no diplopia and no other symptoms referable to the central or peripheral nervous systems.

Examination: The patient was oriented, coöperative, and intelligent. The pupils were irregular and were moderately dilated. The pupil of the right eye did not react to light, that of the left reacted slightly. There was a marked optic neuritis with the discs swollen to an elevation of two-and-one-half diopters, the edema being confined to the nerve head. The veins were engorged, and there were radiating hemorrhages. The extraocular movements were painful and moderately limited. The remainder of the neurological examination, together with the general physical examination, including roentgen studies of the skull and optic foramina, was negative. No focal infections were found. The pressure of the spinal fluid was 175 mm. of water and the fluid contained two lymphocytes per cu. mm. The Kahn test was negative; the colloidal gold curve, 0000000000; the globulin test, 4 plus; and the total protein 46 mg. per 100 c.c.

A diagnosis of acute optic neuritis was made. The patient was treated with intravenous typhoid vaccine, given daily in increasing doses. Following the injections temperature elevations from 101 to 103 degrees were recorded.

Clinical course: Two days after the first examination vision failed completely in both eyes and at the same time the patient complained of numbness of both feet and staggering on walking. There was no pain nor weakness of the extremities, and no disturbance of the bowels or bladder. A few days later there was a slight improvement of vision with peripheral light perception by means of the right eye. The neurological examination on September 14th revealed that the biceps and triceps reflexes were more active on the left than on the right. The knee and Achilles jerks were definitely hyperactive. There was no response following plantar stimulation. Gait and station were normal, but the patient was unable to stand on one leg. The abdominal reflexes were absent on the right but retained on the left. Superficial pain sense was slightly decreased over the lower extremities, but there was no organic distribution. Sensations of vibration, deep pain, motion, and position were retained.

On September 21st the vision was slightly improved. There was peripheral perception of light in both eyes, and the pupils reacted better to light. There was resolution of the optic neuritis with secondary optic atrophy. The gait had become more unsteady, and there was pronounced weakness and numbness of the right leg; also some soreness and numbness in the right arm and axilla. The patient walked with a markedly ataxic gait. He was unable to stand in the Romberg

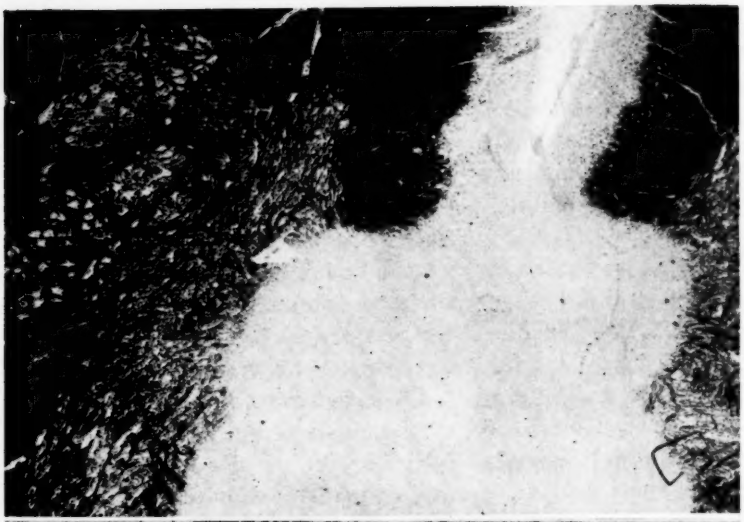

Fig. 1 (Fralick and DeJong). A large lesion destroying parts of the posterior columns and extending into the posterior and anterior horns and anterior tracts. Spielmeyer stain; Zeiss planar, 35 mm.

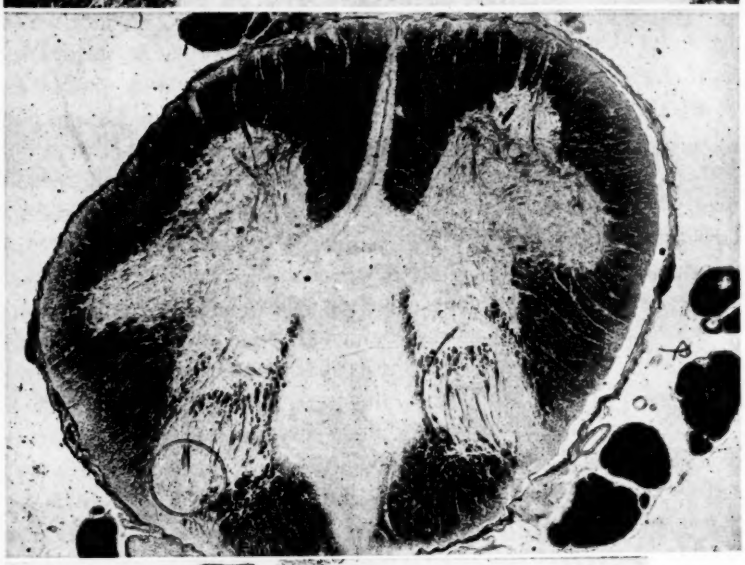

Fig. 2 (Fralick and DeJong). The caudal end of the lesion approximately oval in shape, occupying the white matter of the posterior columns. There is also a slight rarefaction of the marginal white matter. Weigert stain; Zeiss planar, 50 mm.

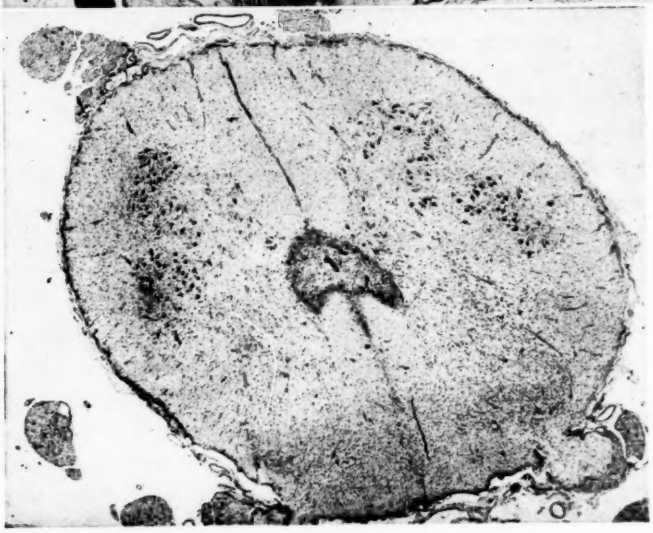

Fig. 3 (Fralick and DeJong). Caudal end of the lesion, occupying the central portion of the lumbar cord and demonstrating a distinct peripheral advancing wall. Nissl stain; Zeiss planar, 50 mm.

position. The biceps and triceps reflexes were exaggerated, and there was a bilateral Hoffmann's sign. The abdominal reflexes were not obtained. The knee and Achilles jerks were markedly increased, especially on the right. There was a bilateral Babinski sign, with sustained ankle clonus, most marked on the right. There had been no further change in sensation. The patient was given potassium iodide by mouth in addition to the typhoid vaccine. On September 25th the right leg was a little stronger, but there was definite weakness in the left. He was unable to move the toes of the right foot. Vision had improved and moving objects could be seen peripherally with each eye. There was numbness of both legs up to the hips and numbness of the abdomen. There was marked constipation. The patient walked with a spastic-ataxic gait. The biceps and triceps reflexes were more active on the left. There was a Hoffman's sign on the right. There was no ataxia nor tremor of the upper extremities. The tendon reflexes in the lower extremities were exaggerated and there was bilateral ankle clonus. Proprioceptive sensations were still normal, but there was complete loss of tactile and pain sensation in the distribution of the 4th and 5th lumbar segments.

The patient was next seen on October 11th. His condition was much worse. He was unable to walk and urinary incontinence with rectal retention had set in. There was a definite bilateral postneuritic optic atrophy; vision was peripheral light perception in each eye. The right arm was weak, with increased reflexes and a Hoffmann's sign. The left upper extremity was normal. The patient was unable to move his right leg or thigh. On the left he could flex and extend the hip weakly. All types of sensation were absent in both lower extremities. On the right the sensory changes were restricted to the foot; on the left there was a sensory level corresponding to the 7th or 8th dorsal segment. There was a marked infection of the urine. The spinal fluid was under a pressure of 230 mm. of water; it contained 10 lymphocytes per cu. mm. The Kahn test was negative; the globulin test, 4 plus; the colloidal gold curve, 0001110000; and the mastic curve, 222111. The patient was discharged from the hospital for further care at home. His condition declined rapidly; decubiti developed over the lower portion of the body. Respiratory failure ensued and death occurred on October 29, 1936. The approximate duration of the disease was two months. The post-mortem examination was restricted to the removal of a small portion of the lumbar cord.

Pathological examination: In the lumbar cord was a large, irregularly shaped lesion that occupied both the gray and the white matter. It was mainly in the posterior horns and the columns of Gracilis and Cuneatus, extending also into the lateral and anterior tracts (fig. 1). The lesion was irregularly oval in shape and was broadened in its middle portion. Lining the anterior median sulcus and spreading laterally for a short distance along the anterior margin of the cord, there was a further lesion (fig. 2).

Histologically the lesions were fairly well demarcated (fig. 3). They consisted of countless microglia elements with elongated, oval, or round nuclei. Scarlet-red sections revealed large amounts of fat. The Holzer stain showed no glial fibers. The blood vessels were greatly thickened, and the perivascular membranes contained numerous microglia elements. Silver sections showed complete absence of axis cylinders, and Weigert and Spielmeyer preparations demonstrated complete destruction of myelin within the lesions. In the latter sections the myelin defect showed an abrupt termination (fig. 1).

The histological picture was that of an

acute destruction of nervous tissues, with no signs of regeneration. There was complete destruction of myelin and axis cylinders, and the lesions consisted exclusively of microglia elements in different stages of development.

Summary

1. Neuromyelitis optica is a disease that is characterized by the presence of an acute bilateral optic neuritis accompanied by a diffuse or transverse myelitis.

2. Pathologically there are areas of complete demyelinization and axis-cylinder destruction together with microglial and lymphocytic proliferation.

3. A case showing both the clinical and histopathologic characteristics of the disease has been reported.

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THE X-RAY THERAPY OF RETINAL-VEIN THROMBOSIS*

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The condition of thrombosis of the central or tributary veins of the retina with consequent hemorrhages was suspected many years before the first and classical description by von Michel in 1879. Since that time, the subject has been of interest to ophthalmic investigators from three standpoints: description and coördination of clinical appearances, etiology, and micropathology. But the treatment has been handled cavalierly. In the exhaustive work by Leber in the second edition of Graefe-Saemisch, an even hundred pages are devoted to the various aspects of retinal-vein thrombosis, but only one half of one page to the treatment.

So let us now reverse the procedure and touch but lightly upon the well-known aspects and devote somewhat more time to a discussion of the complications and the therapy. Etiologically considered, it is now believed that there are two major and one minor factor concerned in the production of a retinal-vein thrombosis. The first is the toxic condition that produces an endo- or mesophlebitis whence the thrombus can originate. The second is the slowing of the bloodstream in the retinal artery with corresponding slowing of the blood column in the vein, thus permitting fibrin and cells to be deposited at the site of the thrombus. The third and minor factor is the anatomical malformation of the vein, which contributes to the slowing of the blood stream. Let us now consider these factors seriatim and see how they combine to produce the end result.

Leber was probably the first to emphasize the importance of the arterial slowing. He found that in all cases of central-vein thrombosis, the central artery of the retina was markedly decreased in caliber, but whether due to a systemic disease or to a purely local condition could not be told. Undoubtedly, in some cases, a sclerosing process of the lamina cribrosa contributed by a mechanical choking of the vessel. In other instances, syphilis or some other systemic toxemia produced a sclerosis of the vessel itself with consequently narrowed lumen and slowed blood stream. In many instances, the artery and the vein lie in such close approximation that perivascular inflammation of one vessel will affect the other and thus decrease the lumen. These are facts and not theory, proved in the anatomical studies of Harms, Scheerer, Coats, and Leber. As the arterial lumen is narrowed, the entire retinal circulation is slowed, and the blood stream in both the arteries and the veins takes a longer time to pass any given point.

But even if the blood stream is slowed, the fibrin and cells will remain in suspension unless there is a *rough spot* upon which deposits may collect. Such a spot must, of course, be in the endothelium where it is in contact with the circulating blood. Verhoeff believes that such a rough spot is purely an endothelial proliferation and that thrombosis in the true sense of the word does not exist. His belief is based upon a microscopic study of the serial sections of six cases, one fairly early; but his theory has not found acceptance among other investigators. It is far more probable that the rough spot in the lining of the vein is the result of an endo- or mesophlebitis of systemic origin. Any toxemia can cause such an inflamma-

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tion, and consequently the literature is flooded with reports of central-vein thrombosis due to a variety of conditions that vary in intensity from a mild respiratory infection to the severest lues. Apparently, there is no one toxemia that can be held responsible, although vascular sclerosis leads all other possible factors in frequency.

When the rough spot in the venous intima has once been produced, there occurs next either an endothelial proliferation, as Verhoeff claimed, or a deposit of fibrin and blood cells, as shown by numerous anatomical investigators. This is, of course, deduction, for there has never been a microscopic examination of a beginning or just-completed retinal-vein thrombosis. But as the picture can be read in the serial sections of the earlier cases, the primary deposit of blood constituents forms a nodule that protrudes into the lumen of the vein, thus narrowing the latter. The blood stream is in this manner slowed still further, and the slower the blood stream the greater is the deposit upon the nodule. The latter probably starts as a flattened area and increases in three dimensions until finally there is no further lumen to the vein or until the lumen is so narrow that the circulation in that vessel is nearly completely at a standstill. In either case, the end result is the same, and there appears rapidly the well-known ophthalmoscopic picture of retinal-vein thrombosis.

The process may occur in the central vein or in any tributary branch thereof, the mechanisms of production being identical. But in the peripheral branches, few of which have come to microscopic examination, it is believed that the lumen is completely obturated by the thrombus, whereas in the central vein, the clinical manifestations may follow only incomplete closure of the vessel.

The third factor lies in an emergence of the central vein from the optic nerve immediately behind the eyeball instead of the normal seven to 15 millimeters posterior to the lamina cribrosa. This is, of course, a congenital anomaly. Attention was first called to this by Harms, who found that in 10 of the 12 cases he examined, the central vein emerged from the optic nerve about one-and-one-half millimeters behind the eyeball. As a result of this anatomical abnormality, the central vein undergoes two sharp bends instead of the gradual curve of emergence, and, in consequence, the blood stream within the vein is somewhat slowed. It would be interesting to try to correlate similar anatomical findings with the clinical presence of marked venous pulsation on the disc. But this third factor is of minor importance as compared to the first two.

A thrombosis may occur in the orbital veins and extend anteriorly into the central retinal vein to produce the characteristic clinical picture. Such an occurrence is accompanied by orbital symptoms that are easy of detection. Again, inflammatory or neoplastic processes immediately behind the eyeball may cause a central-vein thrombosis by pressure or periphlebitic inflammation at that point. The orbital symptoms again complicate the intraocular picture.

Thus the mechanism of production of retinal-vein thrombosis (apart from the rare cases of purely orbital origin) appears to be as follows:

1. Under the influence of some general condition, there is produced a narrowing of the lumen of the retinal arteries that results in a marked decrease in the rapidity of the blood stream.

2. As the result of a generalized toxemia or sclerosis, an endo- or mesophlebitis appears in a vein. This inflammation produces a roughened nodule, primarily probably of endothelial cells, that protrudes into the lumen of the vein.

3. From the blood stream, which has been slowed primarily in the arteries and secondarily in many cases by the sharp retrobulbar bend of the vein, fibrin together with red and white blood cells is caught by the nodule within the lumen of the vein. By these deposits, the nodule increases in size in three dimensions until the lumen of the vein is entirely closed or nearly so.

4. After the circulation of the blood in the vein has decreased to near the vanishing point, the ophthalmoscopically visible manifestations appear in the retina.

After the vein has been more or less completely occluded, the retinal phenomena appear in probably the following order: retinal edema, loss of vision, retinal hemorrhages, exudative areas. When any vein is blocked, pressure of the circulation behind the blockage suffices to drive fluid out of the vein into the surrounding tissue, which is just what happens in retinal-vein thrombosis. Whether this comes from the capillaries or from the vein itself has not been discovered. The retinal edema is not intensive and can be seen ophthalmoscopically ofttimes only with difficulty. Probably the rather low degree of difference between the intraocular and intravenous pressure accounts for the degree of the edema.

The retinal hemorrhages vary in extent according to the caliber of the thrombosed vein and the extent of the retinal area drained by that vein. In all probability, the hemorrhages are from the capillaries and not from a rupture of the vein itself. There seems to be no doubt but that individual blood cells can pass through the walls of the vein (see von Hippel, cited by Schieck in Henke-Lubarsch) and diffuse through the perivenous tissues. But the majority of the ophthalmoscopically visible blood seems to come from capillary rupture except in the rather rare cases of preretinal hemorrhages. Then there occurs a true rupture of a vessel, and the blood enters between the hyaloid membrane and the nerve-fiber layer of the retina.

When the central vein is thrombosed, the retinal hemorrhages are irregular in shape, diffused, and scattered throughout the fundus. In this picture, blood is to be found in all of the retinal layers and is there because of extensive capillary ruptures. But when only a tributary of the central vein is stopped, the blood seems to come from the superficial capillaries only, because of the extensive anastomoses of the deeper capillaries. Such hemorrhages occur in a fan-shaped area lying very superficially within the nerve-fiber layer. This can be recognized clinically and has been proved histologically. However, the larger irregular-shaped masses of hemorrhage that are found only too frequently, are located in the outer nuclear layer and are deeper in the third dimension than are the superficial hemorrhages. Such deep blood masses are more destructive to vision, are slower of absorption, and are more apt to leave permanent damage than are the hemorrhages within the nerve-fiber layer. The massive preretinal hemorrhages that are to be seen occasionally are the most destructive of all, for the absorption is very slow and there is likely to be considerable nerve-fiber destruction with consequent optic atrophy.

The white exudativelike areas that so frequently appear subsequent to the partial absorption of the hemorrhage may be similar in make-up to the white areas of an albuminuric retinitis; namely, a coagulation of albumin from the intraretinal edematous process. Or they may consist of thickened nerve fibers in a ganglionlike form, as was proved histologically by Leber in at least one case. In the majority of instances, such plaquelike or rather exudativelike areas persist for a long time

after the retinal hemorrhages have been absorbed, and at times permanently.

The visual disturbances are, of course, due to the retinal edema and hemorrhages, either in the nerve-fiber layer, where pressure interference occurs, or in the outer nuclear layer, where there is an actual destruction of retinal elements. The amount of the disturbance is dependent upon the extent of the thrombosis (whether it is a central vein or a tributary-branch affair), upon the extent and intensity of the retinal edema, and upon the extent and location of the hemorrhages. The recovery of vision is also a factor of many conditions, which will be discussed later.

One of the most interesting phases of retinal-vein thrombosis is the question of subsequent secondary glaucoma. In his excellent text book on "Medical ophthalmology," Foster Moore discussed briefly the onset of hypertension following retinal-vein thrombosis, but gave no figures as to frequency of occurrence. In a later article, he recorded hypertension as occurring in 27.8 percent of the cases that he was able to follow for a longer period of time. Uhthoff found secondary glaucoma in 13 percent of his 103 cases of retinal-vein thrombosis, with an intervening time of from two weeks to 14 years. Leber believed that 12 percent of the cases developed secondary glaucoma. In my own little series of 37 cases, only three, or 8 percent, developed hypertension during the periods that they were under observation (two weeks to 14 years). Inasmuch as there have been comparatively few studies made upon large numbers of cases, the exact incidence of frequency is still unknown. But certain it is that secondary glaucoma develops within three months after thrombosis of the central vein of the retina in from 10 to 20 percent of the cases, but occurs in less than 5 percent in thrombosis of a tributary retinal vein.

Collins and Mayou account for the hypertension by assuming an exudate of lymph into the vitreous chamber, due to the obstructed circulation in the veins. This in turn would cause some of the albuminous secretion of the ciliary body to diffuse backward into the vitreous with resultant swelling of the vitreous and mechanical closure of the chamber angle. But, they add, in some cases the chamber is deep, and the angle is obstructed by an albuminous coagulum. The explanation sounds rather far fetched. On the other hand, Elschnig maintains that the cause of the hypertension is not always the same in different cases. In his article in the Henke-Lubarsch Handbuch he has abstracted the pathological findings of the various authors who have examined such cases and the theories they have deduced as to the cause of the hypertension. Certain it is that in some cases (probably the late ones), there has been a growth of new tissue, heavily vascularized, over the surface of the iris which, in turn, leads to a complete blockage of the chamber angle. These are undoubtedly the cases of severe "hemorrhagic glaucoma." But in other cases, the angle occlusion results only from an albuminous coagulum.

Some of the cases can be accounted for by these anatomical findings, but I am certain that there is a more common cause that has not received adequate attention; namely, a preglaucomatous state in which the altered intraocular circulation precipitates an acute hypertensive attack. The unaffected eye develops a clinically recognizable compensated glaucoma at a somewhat later date. This was the experience in two of my three cases of hypertension, and the same thing occurred in two of the five reported by Foster Moore. He recognized the possibilities of such a situation and consequently made a very careful study of the intraocular tension in 37

cases, carrying the observations on for a period of many years. When no hypertension developed he found that the pressure in the eye with the thrombosis was 35 percent lower than in the unaffected eye (15.7 mm. Hg to 21.3 mm. Hg). Apparently, if the pressure was the same in both eyes after thrombosis of the central retinal vein, hypertension of the affected eye was to be feared.

In view of the known danger of eventual malignant hypertension, it has been the policy of many ophthalmologists to insist upon the daily and continued use of pilocarpine in the affected eye for at least several years or until the danger seems lessened. There is no question but that such a line of treatment will have a definite influence in lessening the danger of an acute hypertension such as would occur in a preglaucomatous eye. But whether the miotic would prevent the occurrence of hypertension of the type that is due to tissue proliferation upon the iris surface or to blockage of the chamber angle by coagulated albumin, is questionable. However, in view of our lack of positive knowledge upon the subject, the continued use of a miotic as a preventive is a wise precaution.

Ever since the condition was first recognized, the standard treatment of retinal-vein thrombosis was the internal use of iodides, a procedure of problematical value. Systemic treatment was also aimed at the sclerotic or hypertensive conditions that seemed to be present in the majority of cases. All forms of local treatment were of questionable value. In 1930, Löwenstein and Reiser published a rather extensive article upon radiation of the eye with thrombosis of the central vein, based upon their experience with two cases in which the vision returned to normal. But from their description of the cases, it would appear that the thromboses were incomplete, and many of these cases, as we well know, resolve spontaneously with more or less complete recovery of vision.

The work of these two authors was stimulated by a report by Hessberg in 1920, who used irradiation in several cases of retinal hemorrhage of varied etiology with resultant rapid and complete absorption of blood. The explanation was found in David and Gabriel's work, who reported that small doses of filtered X rays cause vasodilatation, while larger doses of unfiltered rays cause vasoconstriction. The blood absorption from the retina, they believed, was hastened by the vasodilatation. (If that is the case, paralysis of the cervical sympathetics should do the same work more effectively.) Furthermore, thrombolysis and the development of vascular anastamoses were supposed to be stimulated by the radiation. At the 1936 meeting of the German Ophthalmological Society of Czecho-Slovakia, Braun reported upon seven cases and Asher upon 23 cases of retinal-vein thrombosis in which irradiation had been employed according to the Löwenstein technique. They agreed that the treatment was apparently of some value in the less severe cases, but did not seem to influence the cases in which the thrombosis was complete. But neither Löwenstein nor the latter two authors mentioned anything regarding the intraocular tension.

In 1929, after a personal discussion with Löwenstein upon this topic, I determined to try irradiation in such cases with particular reference to the influence upon subsequent intraocular tension. So X-ray treatment was used in 16 cases, nine of thrombosis of the central vein and seven of thrombosis of a tributary vein. The dosage was essentially the same in each case; namely, from three to six exposures of filtered rays up to the extent of one quarter to one third of a skin erythema

dose. This is not enough to cause epilation nor to have any influence upon the lens. In none of the irradiated cases was any miotic used unless a definite hypertension occurred.

As a control, the cases of retinal-vein thrombosis that were observed over and during a similar period of time were summarized. This series comprised seven instances of thrombosis of the central vein and 14 of a thrombosis of a tributary vein. In all of the central-vein cases 1 percent pilocarpine was given for use twice daily for at least several years or until the apparent danger of hypertension had passed; in none was irradiation employed.

The period of observation of the cases in these two series varied from several weeks to as high as 10 years. Tension was measured digitally in all cases and tonometrically in the majority. I was not able to confirm Foster Moore's observation of decreased tension in the affected eye as indicative of lack of danger of subsequent hypertension. Neither was I able to agree with Löwenstein as to greater rapidity of absorption of the retinal hemorrhages under X-ray therapy. This coincides with the findings of Braun and Ascher. Furthermore, the visual end results were no better after irradiation than in the unirradiated eyes; but, of course, we do not know what the final vision might have been had X rays not been used.

The following is a summary of my 37 cases, divided as to the vein that was occluded and as to the therapy employed.

THROMBOSIS OF THE CENTRAL VEIN

Class A. Seven patients. All used pilocarpine over varying periods of time. None were irradiated. Period of observation varied from one month to five years. The final vision was: 1.0, 0.2, 0.1, 0.1, 10/200, ability to count fingers, no light perception (bilateral glaucoma).

Class B. Nine patients. All were irradiated. None used pilocarpine. Period of observation varied from two weeks to six years. The final vision was: 0.4, 0.4, 16/200, 10/200, 2/200, 2/200, ability to detect hand movements (in 3 cases, once in unilateral glaucoma).

No difference in the time of absorption of retinal hemorrhages could be noted.

THROMBOSIS OF A TRIBUTARY VEIN

Class A. Fourteen patients. No pilocarpine was used. No irradiation was used. Period of observation varied from two weeks to 10 years. Final vision was: 1.2, 0.6, 0.6, 0.6, 0.6, 0.5, 0.5 (bilateral glaucoma), 0.2, 0.2, 0.1, 10/200, 10/200, 3/200, ability to count fingers.

Class B. Seven patients. No pilocarpine was used. All were irradiated. No glaucoma developed in any case. Final vision was: 1.2, 0.3, 0.2, 0.1, ability to count fingers, ability to count fingers, light perception.

No difference in time of absorption of retinal hemorrhages could be noted.

As can be seen in the summaries of the series, glaucoma developed in one case of central-vein thrombosis, in which irradiation had not been used. But this was bilateral, the unaffected eye developing a true compensated glaucoma shortly after the rise of tension had appeared in the eye with the venous thrombosis. Both eyes were trephined and subsequently maintained normal tension, although light perception was lost in the eye with the thrombosed vein.

One case of unilateral hypertension developed among the eyes with central-vein thrombosis that had been irradiated. This appeared as an acute incompensated glaucoma about six weeks after the final X-ray treatment. No new tissue nor vessels could be seen on the surface of the iris. After a few days of failure to respond to miotics, a trephining operation was performed and the tension has remained normal for two years. Hypertension did not appear in the fellow eye.

One case of compensated glaucoma developed in the series of tributary-vein thrombosis that had not been irradiated. This was a thrombosis of the superior temporal branch of the vein. Four weeks later, hypertension developed as a chronic incompensated glaucoma that necessitated

a drainage operation. Four months later, compensated glaucoma appeared in the fellow eye, but has been well controlled with miotics alone.

From these few statistics, it would not appear that irradiation is entirely successful in preventing secondary glaucoma subsequent to retinal vein thrombosis. But I have a very definite impression that this therapy is of value in that respect and I intend to continue its use, probably somewhat more intensively in the future. But from the standpoint of rapidity of absorption of retinal hemorrhages, no difference could be noted between the eyes that were irradiated and those that were not. From the standpoint of final vision, it is evident that X-ray therapy is of no material benefit. But from the study of this and similar series of cases, it can be seen that a fairly high percentage of cases of hypertension secondary to retinal-vein thrombosis occurs in preglaucomatous eyes in which hypertension would eventually develop, even without the ocular insult. The latter merely precipitates an acute attack. The prevention of hypertension in the eyes that are not of the preglaucomatous type can be aided either by the continued local use of a miotic or by radiation therapy in a high percentage of cases.

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THE EYE IN NEUROLOGY*

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This presentation is intended not to bring out anything new in neurological ophthalmology, but merely to outline and reëmphasize some points of common interest to both the ophthalmologist and the neurologist. The late Dr. John Fulton once said that the optic chiasm was the cross-roads between neurology, ophthalmology, and physiology. It is the writer's own opinion that to practitioners of internal medicine the ophthalmoscope is a more important instrument than the stethoscope.

This communication will merely mention some of the neuropsychiatric conditions in which ophthalmological signs and symptoms play an important part. No attempt will be made to classify these conditions according to pathological anatomy or to etiology, but the various ocular structures will be considered in their topographical sequence.

PUPILLARY ANOMALIES

Argyll Robertson pupil.

Recently our thinking concerning this phenomenon has grown a little careless, and many people regard *any* condition of the pupil in which there is reflex rigidity to light but response in accommodation as an Argyll Robertson pupil. This is not correct. The true Argyll Robertson pupil is miotic, usually irregular, dilates but slightly if at all under a mydriatic, and is fixed to light but responds in accommodation. Now, many observers regard an Argyll Robertson pupil as being pathognomonic of syphilis of the central nervous system, although Foster Moore and others have described this sign in what they believed to be nonsyphilitic conditions. However, in by far the vast majority of cases the *true* Argyll Robertson pupil is due to syphilitic involvement of the central nervous system, and when it is present in a given case, the burden of proof rests with him who says it is not of luetic origin.

Reflex rigidity in conditions other than syphilis.

There are well-known conditions other than lues in which one sees a pupil that is fixed to light and responds in accommodation but is *normal in size* or even enlarged. These conditions are not infrequent.

(1) Cerebral arteriosclerosis (courtesy Dr. E. M. Hammes). F. R., a single, white male, aged 19 years, had a negative family history except that the mother has hypertension. His birth and development were normal. One year previous to examination the patient began to have peculiar involuntary tonic spasms of the left arm. The arm would abduct, flex, and the hand be drawn across the chest with the palm downward. This would last for a few seconds and then the arm relaxed. There was definite mental impairment in the form of decreased cerebration, lack of attention, and impairment of memory for recent events. Physical examination showed a poorly developed, undernourished boy with no gross abnormalities nor deformities, but with a marked peripheral and retinal arteriosclerosis. His blood pressure was 138/92.

The neurological examination showed both pupils to be dilated, the left more than the right, fixed to light but responding promptly in accommodation. There was a questionable weakness of

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the left facial nerve, the muscle tone in the left arm was increased, and the tendon jerks were hyperactive. The blood Wassermann reaction was negative. The cerebrospinal fluid had a negative Wassermann reaction, no cells, a negative globulin and a negative colloidal gold curve. The patient ran the usual course of cerebral arteriosclerosis.

(2) Chronic encephalitis. B. P., married, a male, aged 38 years, was a telegrapher, who had been referred to me by Dr. Wm. Heck, of Saint Paul, because of trembling sensations inside of his body of one year's duration. Later he began to have vertigo and various anxiety reactions. The condition was thought at first to be functional because the patient was worrying about some naturalization papers and had considerable disturbance in his emotivity. Then followed a progressive impairment in concentration, and he finally lost his job because of incompetence. His past history showed that six years previously he had had diplopia for about six months, and during that period slept considerably.

The neurological examination showed slightly dilated pupils that were fixed to light but responded in accommodation. The left pupil was slightly larger than the right. The general habitus and attitude was one of mild Parkinsonism. Serological reactions of the blood and cerebrospinal fluid were negative for syphilis. A few weeks after I examined him, the patient developed typical postencephalitic oculogyric crises which, as is often the case, were temporarily relieved by the oral administration of sodium amytal. This patient is now taking 10 mg. of benzedrine sulfate five times a day and has resumed his work as a telegrapher.

(3) Chronic alcoholism. In our wards at Ancker Hospital, in Saint Paul, inexperienced internes are frequently deceived into making a diagnosis of syphilis of the central nervous system in cases of chronic alcoholism, because these patients frequently have pupils that are fixed to light but respond in accommodation. However, these pupils are *not miotic.*

(4) Barbiturate intoxication, especially veronal (barbital). The patient was seen by Dr. E. M. Hammes. A. H., a single male, aged 35 years, was given a prescription for 5 grains of veronal to be taken at bedtime to induce sleep. Fourteen years later he reappeared with slurring speech, fixed pupils, and a facial tremor. Another neurologist made a tentative diagnosis of nervous-system syphilis but changed it when the patient's blood and cerebrospinal fluid were reported negative in routine tests. It was then discovered that the patient had been taking veronal continuously ever since it was originally prescribed, but as the years passed his tolerance and requirement increased so that he now was taking from 40 to 60 grains every evening. He was sent to the hospital, the veronal was discontinued, and in a few weeks the facial tremor and slurring speech had disappeared, the pupillary reaction returning to normal.

(5) Tumors of the brain and disseminated sclerosis may occasionally produce reflex rigidity to light without affecting the pupillary reaction in accommodation.

Horner's syndrome.

This syndrome of miosis, enophthalmos, and ptosis is due to interruption of the sympathetic nerve fibers running from the lateral horns in the 8th cervical and 1st dorsal segments of the spinal cord to the inferior cervical ganglion. It is frequently accompanied by anomalies of sweating on the affected side of the face and is seen associated with

(1) Klumpke's paralysis. This is a paralysis of the muscles supplied by the inferior cord of the brachial plexus

(small muscles of the hand, thenar and hypothenar eminences, the interossei, and sometimes a few muscles of the flexor group of the forearm) and is due to tumor or trauma involving the supraclavicular space on the affected side.

(2) Evulsion of the phrenic nerve. I have seen one case of Horner's syndrome following surgical evulsion of the phrenic nerve for pulmonary tuberculosis. Evidently the cervical sympathetic fibers were injured at the time of the operation.

(3) Caries of the lower cervical and upper dorsal vertebrae.

(4) Hematomyelia. An unmarried girl of 26 years was thrown from an automobile, striking the back of her neck. She suffered a flaccid paralysis of both arms, with atrophy and absent tendon reflexes; a spastic weakness of both legs with hyperactive tendon reflexes and a right positive Babinski response. Sensation was normal over the extremities and body. There was a bilateral Horner's syndrome. The diagnosis was hemorrhage into the cervical portion of the spinal cord (hematomyelia), and the patient made an almost complete recovery in 18 months.

(5) Thrombosis of the posterior inferior cerebellar artery. This well-defined clinical syndrome results from an infarction of the lateral portion of the medulla oblongata between the hypoglossal nucleus and the restiform body, including the reticular substance from which sympathetic impulses arise. Horner's syndrome in the affected side is present in a large percentage of cases.

Extraocular palsies

Whenever possible, we must differentiate between nuclear and infranuclear lesions. Infranuclear lesions may be either intracerebral or extracerebral. If extracerebral they may be either intracranial or extracranial.

Nuclear lesions.

The third- and sixth-nerve nuclei are the most frequently involved, and if part of the nucleus is spared, only part of the muscles supplied from that nucleus will be paralyzed. Therefore, paresis of only part of the muscles supplied from the oculomotor nucleus indicates a nuclear lesion.

(1) Toxic. The diplopia of alcoholism and poisoning by other drugs (phenobarbital and other barbiturates) is an example of a toxic nuclear lesion.

(2) Syphilis. This disease may affect any of the motor nuclei of the brain stem or of the spinal cord. However, the third-nerve nucleus is most frequently involved, although the sixth is also frequently affected. Usually the disease process does not involve all of the segments of the oculomotor nucleus simultaneously, so one may find a divergent squint followed by a paralysis of the superior rectus on the same side, and then a ptosis of the lid.

(3) Chronic progressive nuclear ophthalmoplegia. This is a degenerative disease affecting all of the oculomotor nuclei. Among neurologists it is known as mesencephalic progressive muscular atrophy. The pathological involvement is analogous to involvement of the anterior-horn cells in the cervicodorsal segments of the spinal cord, causing atrophy and weakness of the small hand muscles and the muscles of the shoulder girdles. The two conditions frequently are associated.

Infranuclear lesions.

These usually involve all of the muscles supplied by a particular nerve.

(1) Intracerebral infranuclear paralysis. A typical example of this type of involvement is the classic Weber's syndrome. In this condition there is a lesion (tumor, hemorrhage, abscess) in the lateral and inferior portions of the pons,

involving the oculomotor nerve before it leaves the brain stem and also the cerebral peduncles on the same side. This latter structure contains the pyramidal fibers before they decussate, so the clinical picture is that of an oculomotor paralysis on one side, associated with a contralateral hemiplegia.

(2) Extracerebral intracranial lesions.

a. Gradenigo's syndrome.

b. Syndrome of the sphenoid fissure. The explanation of this clinical picture is based upon the anatomical fact that the oculomotor nerves and the ophthalmic branch of the trigeminus pass through the sphenoidal (superior orbital) fissure. A lesion at this point, usually a periostitis similar to the periostitis at the stylomastoid foramen causing Bell's palsy, will cause an oculomotor paralysis associated with impaired sensation over the forehead on the affected side. The condition usually responds well to heat, salicylates, and iodide.

(3) Extracerebral extracranial lesions.

a. Myasthenia gravis. In this condition the diplopia and ptosis may precede the onset of other symptoms of myasthenia gravis by months or years. I once saw a patient in whom diplopia and nystagmus had been present for 28 years before the myasthenic symptoms appeared. During these years he had worked as a blacksmith without having any fatigue symptoms. The nystagmus in myasthenia gravis is of a peculiar, jellylike character that I have never seen in any other condition.

b. Hypothyroidism. M. H., married, a female, aged 44 years, was referred to me by Dr. H. E. Binger because of diplopia and a bilateral ptosis. She also complained of extreme fatigability, saying that she was unable to climb a flight of stairs without resting on the way. She was able to begin any physical test with a fair amount of strength, but after a short period of effort would become exhausted and be compelled to rest until her strength returned (myasthenic reaction). In addition to this, her hair was sparse, the skin thick and dry, and the patient had difficulty in keeping warm. The basal metabolic rate was minus 30. Under adequate thyroid medication all the symptoms, including the extraocular palsies and the ptosis, disappeared.

The optic disc

Optic neuritis.

The retrobulbar neuritis of disseminated sclerosis will be discussed later. As far as the other forms of optic neuritis are concerned, the etiologic factors are so varied and some of them so poorly differentiated that the effects on the optic nerve usually involve something more than a purely neurologic approach. However, I should like to mention one case which I believe to be very unusual and which will be reported by Dr. Gordon E. Strate and me elsewhere.

A white male, single, aged 30 years, complained suddenly of dimness of vision in his right eye. The condition progressed, and upon examination a markedly constricted field, with very much reduced central vision was found. The disc was pink but not elevated. Under fever therapy the condition cleared up and the patient returned to work. Two weeks later he appeared complaining of excruciating headache, malaise, anorexia, nausea, and vomiting. Spinal punctures gave a cloudy fluid under greatly increased pressure. Analysis of the fluid

showed 1250 lymphocytes, 95 mg./100 c.c. total protein, a negative Wassermann reaction, and negative colloidal gold findings. A diagnosis of benign lymphocytic meningitis was made and the condition treated conservatively. Recovery took place in three weeks. This is the only case I have ever seen in which a lymphocytic meningitis followed an optic neuritis. At no time were there any symptoms of encephalitis, and the temperature remained normal throughout the course of the illness.

Choked disc.

(1) Tumors of the posterior cranial fossa. The most rapidly developing and highest degree of choked discs are seen in cases of cerebellar and acoustic tumors because in this location space-occupying lesions press anteriorly against the pons, compressing the aqueduct of Sylvius and causing an early internal hydrocephalus with consequent papilledema. Pituitary tumors do not cause choked disc until they have grown up out of the sella turcica and begin to press upon the floor of the third ventricle. One may have very large frontal-lobe tumors without any sign of choked disc.

a. Foster Kennedy syndrome. Basofrontal tumors will cause optic atrophy from direct pressure upon the nerve on one side and choked disc on the other side from increased intracranial pressure.

(2) Encephalitis lethargica. At one time it was believed by some ophthalmologists that choked disc did not occur in cases of encephalitis. Recently, however, we have seen several cases.

A Jewish boy, aged 14 years, came to see me on April 14, 1936, stating that five weeks previously he had had a "cold," with slight fever and some backache. He was lethargic for three days and then apparently recovered from his illness. Two weeks later he had developed a diplopia which remained constant. The neurological examination was negative except for a bilateral choked disc of 4 D. This finding was corroborated by Dr. Hendrie Grant. There was some weakness of the right third nerve, resulting in a slight divergent squint. The boy was placed on sodium cacodylate intramuscularly and potassium iodide by mouth. One week later the diplopia had disappeared, but the choked disc of 4 D. persisted. A week later the papilledema had begun to subside, and in five weeks it was gone. The patient was discharged as cured.

(3) Serous meningitis. Localized meningeal exudates, nonbacterial in origin, may produce "pseudo-tumor" with choked discs and other signs of increased intracranial pressure. When this condition occurs in the posterior cranial fossa (Meningitis cystica serosa der hinteren Schädelgrube) it may simulate an acusticus tumor, and some patients have been operated upon for this condition. When the process occurs in the vicinity of the optic chiasm (cisterna chiasmaticus) it may simulate pituitary tumor.

Optic atrophy.

The neurologist would always like to determine whether an optic atrophy is primary or secondary, but sometimes it is impossible to differentiate the two.

(1) Primary optic atrophy. Aside from the very unusual conditions, such as Leber's familial optic atrophy, olivo-ponto-cerebellar atrophy, arachnodactylia, and others, primary optic atrophy usually means to the neurologist that there is either direct pressure on the nerve or that the condition is due to central-nervous-system syphilis.

(2) Secondary or consecutive optic atrophy usually follows an optic neuritis or a papilledema. I should like to call attention to the optic atrophy that some-

times follows the intravenous administration of tryparsamide for central-nervous-system syphilis. Some difference of opinion exists as to whether this condition is due to the toxic effect of the drug upon the nerve, or whether it is due to the syphilitic condition for which the drug is being given. I am definitely of the opinion that in some cases the condition is due to tryparsamide, for I have seen cases in which it appeared while the drug was being given, improved when the drug was discontinued, and reappeared when it was again resumed. If changes in the optic nerve do appear under tryparsamide therapy, they almost invariably come on during the first six or eight treatments. First there occurs a narrowing of the visual fields, then subjective disturbance in visual acuity, followed by changes in the appearance of the optic disc. Sometimes the condition is permanent, but in the majority of cases it improves when the drug is withheld.

Field defects

The characteristic field defects of chiasmal and tract lesions are too well known to warrant discussion here. The quadrantic defects produced by tumors of the temporal lobe as well as the altitudinal hemianopsia produced by suprasellar lesions also are well known. I should like to call attention to the fact that the optic atrophy of tabes dorsalis can produce any form of known field defect. Leslie Paton, of London, has a collection of hemianopsias, glaucomatous fields, and concentric narrowings that represents all known varieties of field defect that are due to tabes dorsalis.

Disseminated sclerosis

This disease is classed separately because it can produce a great variety of ophthalmologic signs, and also because nearly 50 percent of all patients with disseminated sclerosis give a history of ocular disturbances having been present at some time or other during the disease.

Extraocular palsies.

Diplopia is an early and sometimes the only symptom in disseminated sclerosis.

A white female, single, aged 38 years, was referred to me by Dr. Karl C. Wold, because of diplopia due to a weakness of the left abducens. Five years previously she had had numbness, weakness, and ataxia of both legs with some sphincter weakness lasting for several weeks. Three years later she had a numbness and clumsiness of the left arm lasting for six weeks. She then remained well until her present illness. The neurological examination showed a weakness of the left 6th nerve; exaggerated reflexes, some ataxia of the left arm, absent abdominal reflexes, exaggerated knee and ankle jerks, and a bilaterally positive Babinski. The patient was put on quinine and a high-vitamin diet and went into a remission in three weeks.

Involvement of the optic nerve.

A white female, married, aged 35 years, was seen in June, 1936. Five years previously she had some trouble with her legs and her left arm and was obliged to use a cane for two or three months. She recovered from this disturbance without sequelae. Subsequently, at intervals of about a year, she had attacks characterized by loss of control of one or more extremities. On one occasion she had an attack of dimness of vision in one eye lasting for several weeks. There also had been occasional sphincter weakness. Five days prior to my seeing her she had suddenly lost vision in her left eye. The neurological examination showed the left pupil to be fixed and the disc white. There was a positive Romberg's sign with ataxia and ankle clonus on the right. Babinski reflexes were bilaterally positive. The

patient improved on quinine by mouth and foreign-protein fever therapy.

Sometimes optic atrophy occurs as an isolated phenomenon in disseminated sclerosis, and this is known as *neuromyelitis optica.* I believe that many cases of neuromyelitis optica, if watched long enough, will develop other symptoms of disseminated sclerosis.

a. A white male, single, aged 16 years, was referred to me in December, 1936, by Dr. B. G. Levin. A few weeks previously the vision in his left eye had become blurred and the condition had persisted ever since. The neurological examination was entirely negative except for some pallor of the left optic disc. The patient will be checked at intervals to note the appearance of other signs of disseminated sclerosis.

Treatment.

It is extremely difficult to evaluate the therapeutic effectiveness of any measure used in the treatment of disseminated sclerosis. This is due to the fact that the disease is characterized in many instances by the appearance of spontaneous remissions. Whatever therapeutic attack is being waged at the time of the remission is apt to be credited with the patient's improvement. However, I am convinced that quinine by mouth, a high-vitamin diet, and liver extract intramuscularly is of value in many cases. I have heard patients volunteer the information that the treatment helped them, and I have two patients who refuse to allow me to discontinue their injections of liver extract. Foreign-protein fever therapy may be a two-edged sword, and some neurologists, especially Tracy Putnam, believe this form of treatment to be definitely contraindicated. However, I have used it in a great many cases with distinct benefit in some and with harmful effects in very few. The therapeutic effect of this form of treatment is believed to be due to the improved circulation in the central nervous system resulting from vasodilation. To produce the same vascular response, cervicodorsal sympathectomy has been performed in a number of cases with some good results reported. I have had the operation performed in only one case and the results were disappointing.

Cerebral lesions

Hemorrhages or tumors in different parts of the brain may produce a variety of ocular manifestations, ranging from changes in the optic disc to a great variety of field defects, depending upon the size, location, and age of the lesion. I should like to call attention to the rare but extremely interesting condition of mind blindness (Seelenblindheit) resulting from an interruption of the fiber pathways between the visual cortex and the elaboration areas in the parietal lobes. I had an opportunity to study a case pathologically in the clinic of Professor von Monakow at the University of Zürich.

A white female, aged 65 years, had an attack of left homonymous hemianopsia followed in about one month by a right homonymous hemianopsia, and, later, a left hemiparesis. During the next few months the motor disturbances disappeared but there remained a slight left hemianesthesia. One year later the patient began to have attacks of petit mal and later attacks of grand mal followed by transitory bilateral deafness. Upon examination she was found to be mind blind; that is, she could describe an object but was unable to name it. When shown a sponge and asked to tell what it was, she would ask, plaintively, "Bitte, Herr Doktor, darf ich's nicht anfassen?"* She could identify objects only through special senses other than vision. She called a rabbit a dog, because at the time she

* Please, sir, may I not touch it?

was observing the rabbit a dog howled in an adjoining room. She was able to write better with her eyes closed than with them open, and better able to write from dictation than from copy. At autopsy both occipital lobes were found to be largely destroyed, but part of the optic radiations and the calcarine cortex were preserved. There also was destruction of parts of the temporal lobes and the conduction pathways from the occipital to the temporal lobes were completely destroyed.

Professor Von Monakow stated that in about 50 percent of the cases reported, lesions were found in both occipital lobes and that mind blindness was most pronounced in cases in which the splenium of the corpus callosum was also involved.

In closing, I wish to reiterate my opening statement to the effect that my sole purpose in presenting this paper was merely to outline some points of common interest to both the ophthalmologist and the neurologist.

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OSTEITIS DEFORMANS WITH PIGMENTED CORNEAL DEGENERATION*

SECOND CASE ON RECORD

ROBERT VON DER HEYDT, M.D.
Chicago

During February, 1937, a male patient, aged 57 years, was brought to the infirmary for an examination with the slitlamp. He presented a pigmented bilateral corneal condition the like of which I had not seen.

A horizontally oval area covering about one half of the middle of both corneae presented a fairly well-circumscribed, opaque, milk-chocolate-colored patch. The surface was covered by epithelium, hence smooth. There was no conjunctival redness nor bulbar inflammation (figs. 1 and 2).

On careful inspection with the narrow beam of the slitlamp the clouding was seen to be most intense at the level of Bowman's membrane, and gradually to lessen as it involved the deeper stroma. It differed from band-shaped keratitis mainly in that a pigmentation was present. In band-shaped keratitis there is a calcification of Bowman's membrane. There may be fractures and short cracks in the membrane as well as round clear foramina. These changes were all present in one or the other eye of this patient. The halos are areas spared by the degeneration and undoubtedly were the sites of vacuoles during the process. Numerous short linear clefts were present, especially in the right eye, as well as a definite irregular crack, evidencing a brittle structure.

The lesion was kidney shaped in the left eye and therefore spared the pupillary area. In this eye there were two half-millimeter and four smaller round foramina. Most peculiar was the milk-chocolate coloration, not unlike that of the underlying iris. This together with the glossy surface made the lesion quite invisible on ordinary inspection.

It so happened that just at this time the January, 1937, number of the Klinische Monatsblätter für Augenheilkunde appeared and the initial article by Fr. Peppmueller of Zittau in Saxony described the first reported similar pigmented cor-

* Read before the Chicago Ophthalmological Society, May 24, 1937.

neal degeneration complicating an osteitis deformans (Paget's disease).

A closer inspection of our patient disclosed a suspiciously similar osseous condition. The pigmented, bilateral, slowly progressive corneal degeneration in Peppmueller's case had been under observation for seven years. A description of a section cut from the corneal lesion was given by Rohrschneider. "In Bowman's membrane there is a deposit of minute spheroidal bodies. Some of these have involved the anterior parenchymal corneal layers. The particles are not soluble in acids, alkalies, or fat solvents. The reactions to calcium and iron were negative. The lesion stains intensely with hematoxylin. There is no double refraction with a polarized-light microscope. The deposit is probably albuminous and may be similar to the one described by Lugli, which he calls 'degeneratio corneae sphaerularis elaoides'" (Arch. f. Ophth., 1935, v. 134, p. 3).

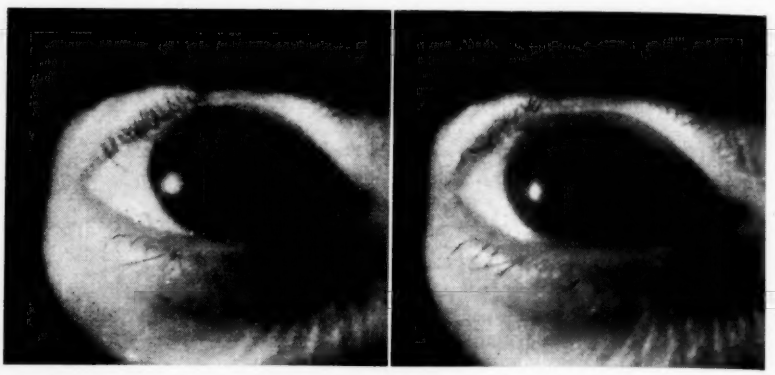

Fig. 1 (Von der Heydt). Stereoscopic view of the right eye showing pigmented corneal degeneration in osteitis deformans.

In this report Lugli described a bilateral senile change at the nasal and temporal limbus composed of canary-colored translucent droplets not soluble in fats and expressed his opinion that they belong in the group of hyalinoses as described by v. Recklinghausen.

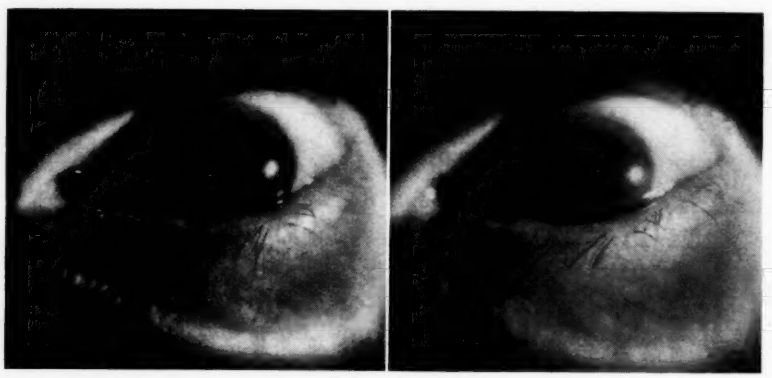

Fig. 2 (Von der Heydt). Stereoscopic view of the left eye in the same patient.

The incipience at the limbus, however,

is radically different from the circumscribed central lesions in the present case and in that of Peppmueller. This differentiation is very important. I have always reasoned that corneal lesions originating near the limbus may be influenced by factors brought there by the blood current, while a central incipience may in a greater measure be due to local factors, resident within the corneal tissues. An exhaustive eight-page illustrated description of the 62-year-old male patient suffering this corneal lesion and osteitis deformans (Paget) is given by Peppmueller and his associated medical and orthopedic colleagues.

Dr. Kopp, resident at the Infirmary, compiled the following case history in this second instance of the disease to be reported:

J. M., aged 57 years, a white male, three weeks before admission to the infirmary had first noted a brownish veil over his right eye. He had no complaints relative to the left eye. His general history revealed the following significant findings:

(1) Repeated fractures—beginning at the age of 25 years—first of the right ankle, then of the left patella, the right patella, the left elbow, the skull, and the right femur. Some of these fractures occurred on very slight trauma.

(2) His record of two years ago at the Cook Country Hospital gave the diagnosis as pathological fracture and it was noted that the patient had blue sclerae. His past history otherwise was entirely negative. Upon inquiry regarding exposure to metal particles it was stated only that the patient had worked on the copper dome of the post office for two months and that he had worked with sheet metal intermittently from the ages of 23 to 25 years. There was no history of local or general medication; for instance, silver, iron, copper, arsenic.

No similar changes, either general or ocular, had occurred in other members of the family.

Physical findings: These showed the osseous changes characteristic of osteitis deformans (fig. 3). The diagnosis was confirmed by Dr. Sidney Sideman, of Michael Reese Hospital Orthopedic Department. There were no other significant

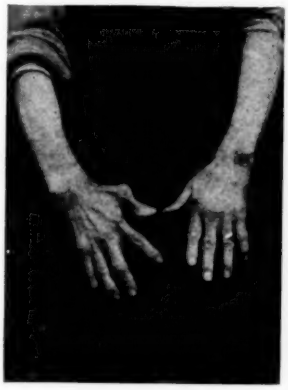

Fig. 3 (Von der Heydt). Osteitis deformans.

findings in the general physical examination.

Laboratory findings. Serological examination was repeatedly negative, as was also the urinalysis. The blood count and morphology of the blood cells were within normal limits.

The blood chemistry was normal, except that blood calcium and phosphorus were just at the lower limits of normal. The calcium was 8.9 to 9.8 mg., the phosphorus 3.7 to 3.8 mg., on repeated examinations.

X-ray examination confirmed the diagnosis of osteitis deformans.

It remains as yet undecided whether the corneal condition in these two cases may be due to general arteriosclerosis or presents a metabolic change specific for osteitis deformans.

25 East Washington Street.

A PHOTOGRAPHIC ANALYSIS OF ALTERNATING VISION DURING READING*

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San José, California

Bar-reading or control-reading has been used in the therapy of concomitant strabismus for years. Maddox,[6] Souter,[7] and Higley[5] have described its use for such training, and more recently Davidson[4] has suggested that this technique can be used for several other purposes. Clark[1] has suggested that eye-movement photography presents a method of objective analysis of binocular behavior which should have practical as well as theoretical value in describing what the eyes actually do in various training situations. It was the purpose of this investigation to make an analysis of the alternating vision occurring during bar-reading, to determine the behavior of the eyes, and to compare the results with those obtained during "normal" binocular reading. This particular technique was not studied so much because of its value as a therapeutic method but because it lent itself readily to investigation and comparison with a control study that had already been completed.[2] It was also hoped that it might indicate some general methods that would be useful in studying other training devices.

EXPERIMENTAL PROCEDURE

The experimental procedure was similar to that of the previous experiment.[2] Ten university students had their ocular movements photographed while they read two paragraphs of rather difficult material from the original source. All of the subjects showed "normal" exophoria at 13 inches.

A vertical rod, 30 mm. wide, was placed in the subject's median plane between the eyes and the material. The lines of reading material were 15 cm. long, and the effect of the rod was to divide the line into four sections. These sections occurred on the average as follows: The first section was 21 mm. long and was seen binocularly; the second section, 52 mm. long, was seen by the left eye only; the third section was seen by the right eye only and was also 52 mm. long; and, finally, there was a section 21 mm. long seen binocularly. For some subjects there was also a small section, approximately 4 mm. in size, visible binocularly in the center of the lines. The reading card was lined up by each subject so as to be as nearly as possible in this position.

The effect of this device is that the subjects read first with both eyes, then with the left eye only, next with the right eye only, and finally with both eyes again. This change, of course, gives the method its value in the treatment of concomitant strabismus. It is worth noting that six of the 10 subjects were unaware of the fact that there was any change in the use of their eyes during the reading process. The situation was explained to them after the photographic records were made, and not one reported that there was any difficulty in reading the material.

RESULTS

The bar-readers were compared with the control group for the usual reading measures. The average number of fixations per line for the bar-readers was 9.56 ± 1.4 as compared with 13.59 ± 1.59 for the control group. The average number of regressions was 1.30 ± 0.61 for the bar-readers and 1.8 ± 0.42 for

* From the Psychology Department, San José State College. The experimental work was done in the Psychology Laboratory of the University of Southern California.

the control group. The average reading time per line was 2.70 ± 0.38 seconds for the bar-readers and 3.74 ± 0.59 seconds for the control group. Although the differences between these groups appear to be significant and show that the bar-reading is more rapid, the explanation is to be found in the fact that the subjects used in this experiment were advanced students and hence were relatively familiar with the material, whereas the control group was made up of freshmen who were much less familiar with the material that was read. The data would seem to indicate that the process of changing from binocular vision to monocular vision and vice versa, or alternating from one eye to the other, does not tend appreciably to alter reading efficiency as measured by eye-movement photography.

The binocular changes that occurred would be less affected by the comprehension of the material; hence, the two groups were compared in regard to their binocular behavior. Although the difference was not statistically reliable, the group of bar-readers showed a tendency to overconverge more in moving the eyes from the end of one line to the beginning of the next, as was shown by the divergent recovery movement at the beginning of the lines. The average size of these divergent movements for the bar-readers was 43.5 ± 19.1 minutes, whereas the average of the control group was 30.1 ± 9.5 minutes.

An examination of the data of the control group indicated that approximately 15 percent of the subjects showed a tendency of the eyes to diverge from the second fixation to the end of the line. This divergence seemed to be separate from the divergence that occurred during the first fixation to correct for the overconvergence of the eyes in moving from the end of one line to the beginning of the next. The results for the experimental group are summarized with those of a control group in table 1. The 24-minute differences are used in the table because they indicate half-millimeter displacements on the photographic records.

TABLE 1

A COMPARISON OF THE DIFFERENCE IN THE POSITION OF THE EYES FROM THE SECOND FIXATION TO THE END OF THE LINE FOR "NORMAL" AND BAR-READING

Divergence from the Beginning to the End of the Line			Convergence from the Beginning to the End of the Line
Extent minutes	Control percent	Bar-reading percent	Bar-reading percent
0	85.3	13	—
24	14.5	22	12
48	0.2	19	12
72	0.0	10	7
96	0.0	1	4

It is evident from the table that the bar-readers showed much more variation than the control group reading under usual binocular conditions. As the subjects read through the line, the control group showed no consistent change 85 percent of the time, whereas the bar-readers showed no consistent change only 13 percent of the time. The bar-readers exhibited a consistent divergence in 52 percent of the lines and converged in reading 35 percent of the lines. The convergence and divergence was not only more frequent during bar-reading but was greater. The greatest divergence for the

control group was 48 minutes (1.5$^{\Delta}$), while the experimental group diverged as much as 96 minutes (3$^{\Delta}$) in reading through a line. Not one of the control group converged the eyes in reading through a line, but convergence occurred in 35 percent of the time for the bar-readers, and was as much as 3$^{\Delta}$.

It is important to notice that these large amounts of convergence and divergence of the eyes were present in spite of the fact that there was binocular vision for all subjects at the end of the line. This gave the subjects binocular fixation for the last pauses in each line, but in spite of this fact the eyes assumed a position which would not permit the images to fall on corresponding retinal points. This suggests the possibility that the subjects continued to read with the right eyes at the end of the line and suppressed or disregarded the left eye which assumed a position of either convergence or divergence.

Summary and discussion

The binocular behavior of a group of 10 university students was studied during control or bar-reading. All of the subjects showed "normal" exophoria at the reading distance. The results of this study lead to the following general conclusions:

1. The alternating vision that occurs during bar-reading does not appreciably alter reading efficiency as measured by eye-movement photography.

2. The bar-readers showed much more variation in binocular behavior than did a control group during normal reading. This variation was found both in convergence and divergence in reading through the lines, in spite of the fact that binocular vision was present for the last fixations at the ends of the lines.

These results tend to verify the findings of a previous study, indicating that the eyes do not necessarily assume a position revealed by the measure of heterophoria when they are actually engaged in binocular movements found in reading. When one eye was covered, as in the common cover test to indicate heterophoria, the eyes of these subjects diverged slightly. On the other hand, when "fusion" was prevented by the reading bar, there was a greater tendency of the eyes to converge.

These results also tend to support the findings of another study[3] in suggesting the possibility that at least part of our binocular vision is actually a result of clear seeing with one eye only.

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NOTES, CASES, INSTRUMENTS

A METHOD OF MOTION-PICTURE PHOTOGRAPHY OF OCULAR SURGERY

JOHN P. LORDAN, M.D., AND
RUSSELL L. STIMSON
Los Angeles

The methods of motion-picture photography of ocular surgery have hitherto been complicated and not consistently satisfactory. In order to obtain a small field that gives adequate detail in projection the lens must be not more than 50 cm. from the work. The axis of illumination must approach the axis of the lens as nearly as possible in order to reduce shadows to the minimum. We shall describe a method by which these requirements can be conveniently met.

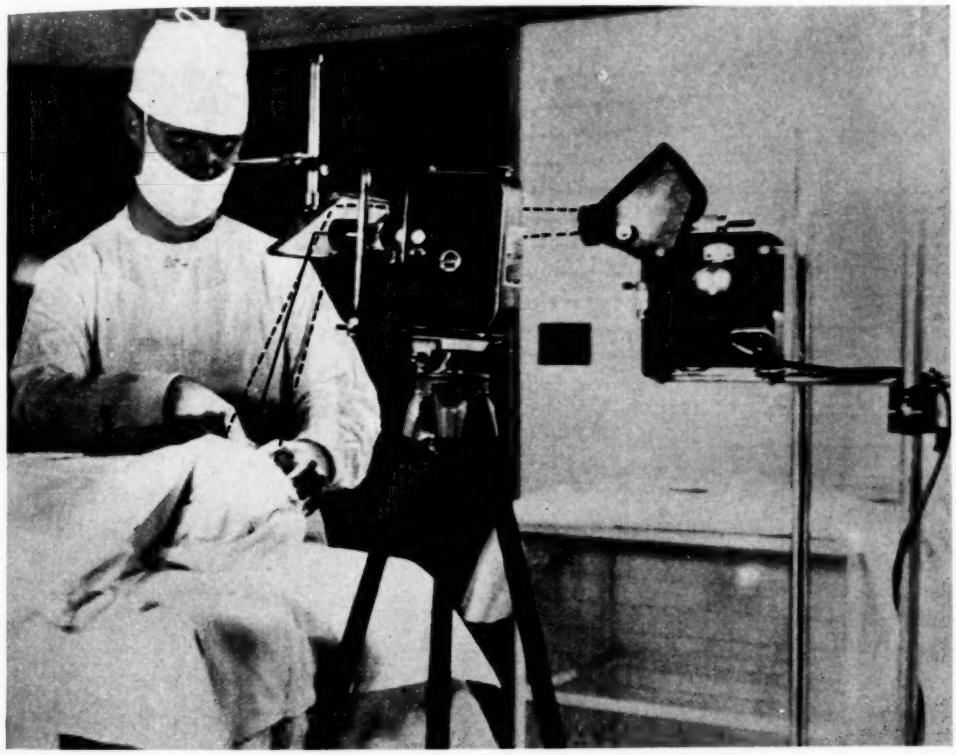

Fig. 1 (Lordan and Stimson). The apparatus in place. Broken lines show the path of light; solid line, the direction of the light entering the camera.

A plate of one-half inch cold rolled steel is screwed to the top plate of a sturdy tripod, such as is available for amateur cameras. To this is bolted the bent arm and mirror holder made of one-half inch seamless steel tubing (fig. 1). The legs of the tripod are steadied by attaching them to an equilateral triangle made of one-by-one-half-inch steel strips 27 inches long. The vertices of the triangle are connected with bolts in which the heads are machined to fit the tips of the tripod legs.

A first surface mirror 5″ × 7″ is mounted in a metal frame and is adjustable vertically and horizontally on the

steel tubing. A pivot on the back of the frame allows adjustments of inclination. The surface of the mirror is a molecular deposit of aluminum-magnesium alloy, which has a high coefficient of reflection in the actinic end of the spectrum. The

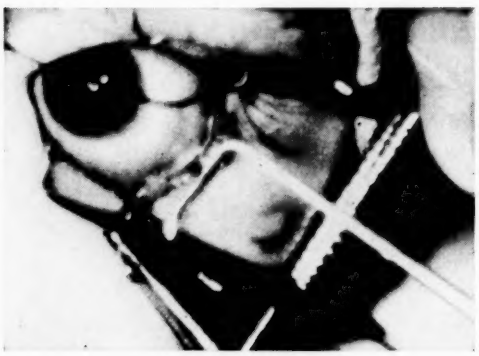

Fig. 2 (Lordan and Stimson). Demonstrating the size of field in a frame of 16-mm. film.

mirror is mounted slightly off center in order that a good area might be available on the right side of the camera for the illumination.

The light source is a clock-feed microarc with white-light carbons. It is mounted on an adjustable stand at the same height as the camera lens. The light is reflected in the mirror and makes a spot approximately 15 cm. in diameter at full aperture. In figure 1 the path of light is represented by the broken lines. It can be used as the focal illumination for the entire operaion. The intensity of the light will be sufficiently great to allow the camera to be stopped down to about f. 8 when supersensitive film is used. The small stop, of course, is desirable because of the increase in depth of focus. Abundance of light makes a slower motion (24 to 32 frames per second) easily possible.

The camera is usually set at the head of the operating table, leaving both sides available to the surgeon and his assistant. If the case requires, the camera can be set at the side of the patient. The inversion of the image in the mirror erects the picture for the camera and the picture is also reversed right for left. The direction of the light entering the camera is represented by the unbroken line in figure 1. Except in sound film the reversal can be corrected by running the emulsion side of the film toward the projector lamp on reversible film, or reversed in printing if one photographs on negative film. Figure 2 is included to demonstrate the size of the field in a frame of 16-mm. film. An O'Connor cinch shortening is shown not in good definition, for this was printed and enlarged from the motion-picture film itself, and consequently has lost detail.

The advantages to the surgeon are: (1) the apparatus is not in his field of action, (2) the operating room is not made uncomfortably warm with large photographic stand lamps, (3) shadows are not cast on the operating field by hands or instruments during the photographing.

The advantages to the photographer are: (1) the arrangement can be assembled for any camera at a minimum expense, (2) the light source is steady and of sufficient intensity to be usable with long-focus lenses, (3) the camera is in its natural upright position, which facilitates focusing, film changes, and so forth, (4) the tripod is level, and the camera can be easily turned in or out of use without refocusing, (5) the mirror serves for both field-finding and focusing when setting up equipment, (6) the apparatus is sufficiently removed from the surgical field to avoid contamination, (7) incisions made in the skin are readily visualized to the depth of the incision and not obscured by shadows of the wound margins.

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SOCIETY PROCEEDINGS

Edited by Dr. H. Rommel Hildreth

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

Section on Ophthalmology

January 8, 1937

Dr. R. O. Leavenworth, *presiding*

The Relation of the Ocular Muscles to Accommodation and Convergence

Dr. Harold O. Cooperman (Minneapolis) pointed out the usefulness of the Berens ergograph for the study of fatigue of convergence and accommodation and the possibility that it will establish future standards for the understanding and interpretation of these two most important functions. He believed also that the screen test, as advocated by Duane and James W. White, is more accurate than the phorometer in testing muscles.

Dr. Cooperman said that exophoria for near should be counterbalanced by at least an equal amount of adduction for near and that esophoria for distance should be counterbalanced by at least an equal amount for distance. He does not see the practical value of adduction tests for distance nor of abduction tests for near, since the former is a near function and the latter a distant function. He believes the insufficiencies give the greater symptoms of asthenopia, the excesses rarely, and are found often by positive examination in persons who come in for a refraction test only.

Discussion. Dr. H. W. Grant (St. Paul) said this is a very important subject because many experimental neurologists are taking up the study of convergence and divergence. Spiegel has recently spent a great deal of time studying the pathways from the higher centers to the nuclei, and has recently demonstrated that the vestibular nucleus acts as a distributing center for all impulses from the higher centers to the nuclei. This is the one anatomical discovery that explains the law of reciprocal innervation. Two other centers of importance in any discussion of the ocular balance are the convergent centers, definitely located as a ventral prolongation of that portion of the third-nerve nucleus which supplies the internal rectus. It is, of course, located there pathologically because of the destruction of the center in epidemic encephalitis. The existence of a divergent center is becoming more generally accepted, supplementing the assumption of divergence as a negative phase of convergence. Late cases of divergent paralysis show a degeneration of the sixth-nerve nucleus and, if such a center exists, it is probably in the region of the sixth-nerve nucleus. These two latter centers control the important functions of binocular projection and binocular single vision.

The second point under discussion is the question of refraction. In many instances divergence insufficiency is associated with myopia, and some men have tried to explain the presence of myopia on the basis of muscle imbalance. Marlow has recently described instances in which there was a marked decrease in the amount of myopia after the correction of the muscle imbalance, whether it be lateral or vertical. He still believes that the increase of the myopia is dependent upon the pressure of the muscles upon the globe. It is important to remember, however, that total correction of the refractive error has proved extremely valuable, especially in progressive myopia, and it is assumed that this correction should be

made with the most careful cycloplegic test.

The third point is the question of examination, and he wished to reiterate one or two of the points in Dr. Cooperman's paper. It seems undeniably true that the prism divergence and the convergent near point are both very constant factors in the examination of the static muscle balance. With the existence of a divergent center the external recti would necessarily control the lateral balance of distance, and the internal recti the balance at the near point. It must be borne in mind, however, that there is considerable difference between the static and the stereoscopic muscle balance, and these two should not be confused. The use of orthoptic training has, however, definite indications in the treatment of muscle imbalance, and one of these is convergence insufficiency. It may be necessary to eliminate any divergence abnormality before treating convergence insufficiency by orthoptics.

Dr. Charles Sheard, Ph.D. (Rochester; by invitation), Director of biophysical research at the Mayo Foundation, as the guest speaker of the evening presented a rather extensive review of his own investigations, as well as those of others, regarding the analysis and interpretation of data on ocular accommodation and convergence.

Single binocular vision may be obtained through convergence derived from (1) concomitance with accommodation, namely, accommodative convergence, and (2) fusion or desire for single binocular vision. By way of illustration he pointed out that, as extreme types, two individuals might possess a total positive fusional convergence of 30$^{\Delta}$ at the customary reading distance of 16 inches; in one case the whole of the convergence needed for single binocular vision might be in association with the accommodation, while in the second instance the accommodative convergence might be zero, thereby indicating a positive fusional demand of 16$^{\Delta}$ to 18$^{\Delta}$ and indicating a positive fusional reserve (adduction at 13 inches) of about 14$^{\Delta}$ (30$^{\Delta}$ — 16$^{\Delta}$). Further analysis indicates the desirability of maximal plus- or minimal minus-lens correction in the first type of case; whereas small amounts of prismatic correction (at least for temporary wear) and the development of the fusion by adequate training are indicated in the second condition. Gradations, therefore, exist in the complement of convergence associated with accommodation, thereby in turn affecting the amount of so-called accommodative exophoria and the fusional reserves. From various considerations he believed that there should be a general acceptance of the two principles which state that (1) one half to two thirds of the total fusional convergence (whether positive or negative, dependent on the disclosure of exophoria or esophoria under dissociation tests) should not be called into play, and hence should be in reserve, for the comfortable maintenance of single binocular vision, and (2) that the accommodative function may be taxed from one half to two thirds of its positive relative amplitude as determined by test at the point of fixation.

Dr. Sheard further developed the line of argument by a presentation of graphical illustrations concerning the determination and significance of the so-called zone of ocular comfort. In essentials, data regarding the positive and negative relative amplitudes of convergence and accommodation are obtained with fixation at 20 feet and 13 inches. The total values of the negative and positive relative amplitudes of accommodation and convergence, respectively, are arithmetically or graphically divided into three equal parts, and the location of the point of equal convergence

and accommodation with reference to the middle third zone is then made. If the point of equal accommodation-convergence (for example, three-meter angles of convergence and three diopters of accommodation) lies outside of the middle third zone, then single binocular vision is quite likely not to be maintained or, if so, with discomfort. Convergence insufficiencies and excesses fall into this category. The least amount of prism (incorporated in the lenses to be worn) that will approximate a restoration to normal relationships is to be recommended, together with orthoptic exercises for the purpose of developing fusional reserves.

Dr. Sheard pointed out that there are four main purposes for which prisms may be prescribed: (1) to compensate permanently for innervational insufficiencies or anatomical (muscular) defects that may be otherwise incorrigible (many conditions of vertical imbalance and of exophoria are in this class); (2) to stimulate proper functioning of an impaired fusional mechanism; (3) to afford temporarily such optical assistance that the innervation which goes to the extraocular muscles is balanced and reciprocal, and the eyes move freely either to the position of equilibrium under dissociation, or to the position of parallelism (at distance) or of requisite convergence (at reading) under fusional stress; and (4) to relieve, temporarily, innervational and muscular tension by inducing relaxation (inhibition) and to aid in establishing normal fusional habits.

In his remarks concerning methods and apparatus for orthoptic training, Dr. Sheard pointed out that he did not limit the consideration of orthoptic training to cases of squint, since, in the last analysis, the classification of degree or strength of single binocular vision is a gradation from normalcy, through instability and insufficiency, to actual trophias. In convergence and divergence excesses and insufficiencies, conditions of diplopia or monocular vision with suppression of vision of the nondominant eye may exist; such conditions are the initial stages in the development of squint. In squint training, the sequence of steps, after correction of refractive errors, is the restoration of vision in the squinting eye and the development of simultaneous binocular vision, followed by the development of fusion with adequate amplitude and, lastly, the development of stereoscopic vision. Various instruments, from the early Wheatstone stereoscope to the Worth amblyoscope and then on to the modern ensemble known as the rotoscope, the stereo-orthoptor, the synoptoscope, and so forth, are fundamentally for the purpose of developing various monocular and binocular functions to the end that single binocular vision may be obtained and maintained if possible. The element of motion of targets, thereby introducing coordinated movements of the eyes with inhibitions and innervations of corresponding antagonists and synergists, has been of decided advantage in squint training and in functional reëducation.

Dr. Walter Fink (Minneapolis) stressed the fact that the exact amount of hyperphoria is a difficult thing to determine. When he finds a case of hyperphoria which may require a prism, he frequently rechecks the patient a second or third time and is very cautious about overcorrecting the error. He again rechecks the muscle balance several weeks after the patient has received the glasses.

Another point he wished to bring out was the dominance of the eyes. He felt that this phase certainly has some place in the daily routine. One should not shift the dominance of the eye; he has had cases in which he has shifted the dominance of the eye with an unfavorable reaction on the part of the patient.

Dr. Fink also maintained that, in his opinion, determination of the duction power of the eyes is more important than the lateral phorias. In determining ductions, he uses both the phorometer and the rotoscope. The rotoscope is particularly valuable because stereoscopic vision is employed and he believes the findings are more stable. It is important to obtain the ductions for both the distance and near. He finds that the recovery point is important in evaluating power of the ocular muscles. Some patients may show very good duction power, but the recovery point is deficient.

Another point he stressed was the importance of examining the cases for reading disability. This is especially true when dealing with children. All the findings in these cases may be negative and their difficulty not explained until the coördination of the eyes is tested. Many of these cases show not only incoördination as to the eyes but a generalized incoördination. Determination of the reading ability is a step in the right direction and something which the oculists will be more familiar with in the future.

In speaking of strabismus, he made the following points: At the strabismus clinic at the university, careful tabulations are made in all cases and, from these studies, a few facts emerge that seem to be quite definitely established. In his experience the rotoscope is a more practical instrument than the synoptophore. It is more flexible, more understandable to the patient, and incorporates the principle of motion to a much more practical degree. He believes motion is one of the essential factors in orthoptic training. One makes a great mistake in attempting orthoptic training with only the single stereoscope.

One must determine not only the presence of stereoscopic vision, but also the amount. Many patients may have stereoscopic vision, but very feebly developed. The Howard-Dolman instrument gives the best idea of the degree of depth perception. For practical office use, a modification of this instrument is of value. It is called the depthoscope and has four targets which can be adjusted to varying distances. If the eyes are normal, these objects are lined up exactly. The instrument has another valuable feature; namely, that it can be used in developing depth perception. The examiner can demonstrate the varying positions of the targets and the patient can grasp the idea more readily. It is especially good for children, for it is easily understood, whereas a stereoscope is frequently confusing.

Another point brought out was the fact that most of our orthoptic training must be done at home, for it is impossible to have patients come to the office daily. The problem is to train the mother, who, in turn, supervises the training of the child. It is necessary, when treating these patients, to keep the child interested, and Dr. Fink said he does this by giving various instruments for use at home.

It has been his experience that the development of stereoscopic vision should not be attempted until the best visual acuity has been developed in the amblyopic eye. Development of the amblyopic eye is very rapid in some cases and in others very slow. Many of the patients treated have developed normal vision and a few have developed better than normal vision. The most practical method of developing these partly seeing eyes is complete occlusion and, if vision is sufficiently reduced, the child is put in a sight-saving class. After being there for several months, most of them have developed sufficient vision to justify their return to the school which they previously attended.

In dealing with strabismus cases, very frequently in addition to esotropia there is hypertropia. Dr. Fink said he has been correcting this hypertropia with prisms,

believing that it eliminates one deviation and at least puts the images on the same plane.

In closing, he stated that he regarded the whole subject of ocular muscles as still in a somewhat confused state, judging from the varying opinions, and the points he had brought out in his discussion were mentioned because he considered them to be of particular importance. He stated how much he appreciated the work of Dr. Prangen, which stresses the importance of near-point measurements. He considers this one of the most essential points in the eye examination.

Dr. A. D. Prangen (Rochester), in a general discussion on orthoptic training, said that in a broad sense orthoptic training can be construed as the employment of any optical device for the aiding of ocular balance. Thus even the correction of ametropia can be considered as such. More specifically, however, the term "orthoptic training" is used to apply to certain forms of optical exercises used in the treatment of various kinds of heterophoria (imbalance) and heterotropia (squint).

At the present time ophthalmologists, as medical men, are chiefly concerned with the use of orthoptic training in the treatment of crosseyed children, for the plight of these unfortunates seems most pressing. It must be admitted, however, that there is a definite place for orthoptics in the treatment of the imbalances or phorias. The ophthalmologist looks with suspicion on the extensive and elaborate use of orthoptics in the treatment of this large group of people. Medically, he realizes the great difficulty in selecting the eyes in need of such training. To him it is apparent that many people showing ocular imbalance are sick. It would be putting the cart before the horse to train such eyes and ignore the medical, surgical, and neurological condition of the patient. One's chief concern, in trying to evaluate the significance of an ocular imbalance, is to judge its relation to the physical and mental status of the patient. Are the eyes primarily or secondarily at fault in the patient's discomfort? So often this is so difficult to decide. It is the oculist's task, as a physician, to weigh these factors and make not only an optical diagnosis but a medical one as well. The successful outcome of treatment depends on this procedure and even the good health or life of the patient. When a balanced diagnosis —medical, neurologic, ophthalmologic, and optical—has been made, it may then be apparent or probable that the patient's discomfort is due to his ocular imbalance. A persistent imbalance with persistent symptoms, following proper medical and neurological treatment, also proper correction of ametropia and presbyopia, leaves orthoptic training and surgery as the next steps to follow. Orthoptics is the the next and logical step after such a selective procedure. By such elimination and selection, orthoptics will not be employed blindly and promiscuously. Thus one can meet the charge of quackery.

Besides such diagnostic selection, one must also select cases for orthoptics, taking into consideration the local, social, economic, and intelligence factors pertaining to the patient and the family. The ability to obtain coöperation, personal direction, and persistent application of the treatment must be considered. Orthoptic training cannot be carried out in absentia. When all these factors are favorable, orthoptic training is feasible not only for strabismus but also for troublesome phorias.

Dr. Prangen said he had been interested in and had employed orthoptic training chiefly in the treatment of strabismus. With the aforementioned factors in mind, orthoptic training does produce cures in some carefully selected cases. To effect

results, orthoptic training must be sufficiently and intensively prolonged. A fair trial is perhaps from six months to one year, although cures have been accomplished only after several years of training and in spite of relapses. There is a great tendency, after training is started, to prolong it past the point where surgical intervention is indicated. Failure to show progress in combating amblyopia or muscular abnormalities is indication for surgery, regardless of the age of the patient. Dr. Prangen said that their youngest patient to undergo surgery was three years of age. Progress in the objectives of treatment, on the other hand, contraindicates surgery. As a preparation for surgery, orthoptics is of unquestioned value. It aids in obtaining a balanced opinion as to the exact status of the muscular apparatus. Following surgery, in the ensuing stage of muscular dysfunction orthoptic training could well be employed to encourage the progress of the eyes to a condition of phoria and thence to fusion or real cure. Dr. Prangen felt that oculists do not do this often enough. The eyes appearing quite straight, the surgeon and the family are satisfied. A little more training might well effect a cure at this vulnerable period.

Dr. Prangen said he thought that in selected cases, under favorable circumstances, orthoptic training has a definite and valuable place in the treatment of strabismus.

COLORADO OPHTHALMOLOGICAL SOCIETY

January 16, 1937

DR. G. L. STRADER, *presiding*

BEGINNING ATROPHY OF OPTIC NERVE FOLLOWING INJURY

DR. H. SHANKEL, Resident Ophthalmologist to the Colorado General Hospital, presented the following cases from the Out-Patient Department.

Mr. D. S., aged 55 years, was kicked in the left eye on January 1, 1937. Emergency treatment was given at Denver General Hospital. When seen one week later at Colorado General Hospital there were marked ecchymosis and edema of the left lids and chemosis of the conjunctiva of the left eye with subconjunctival hemorrhages. The left pupil was dilated and did not react to direct stimulation but showed a consensual reaction. The cornea and media were clear. The fundus showed engorged veins. The arteries appeared somewhat contracted. The disc outlines were normal and the nerve was normal in color. The eye was completely blind. The right fundus was normal, right vision was 20/20. Potassium iodide was prescribed, 10 drops three times a day.

When seen again on January 11, 1937, the patient complained of numbness of the left side of the face and the left cornea was found to be insensitive. The fundus showed no change. The eye was covered because of the insensitive cornea. Roentgenographs were taken, which showed no fracture in the orbit. The Wassermann reaction was reported negative.

On January 14, 1937, fundus examination showed a beginning pallor of the optic nerve, but there was less numbness of the face and the cornea was sensitive to stimulation.

Discussion. DR. W. T. BRINTON commented that X-ray films are often quite unreliable in fractures of the apex of the orbit. Edema or hemorrhage along the nerve is probably responsible for the atrophy in this case.

Dr. W. H. Crisp said that a good proportion of the fractures of the apex of the orbit are without displacement, but cause hemorrhage and edema which affect the nerve. There are no lesions in

the retina. The involvement of the fifth nerve in this case is quite an unusual complication.

Dr. J. M. Shields reported that the disc is undoubtedly much paler now than when he first saw the patient, two weeks ago.

ACUTE GLAUCOMA

Mr. J. F., aged 52 years, entered the hospital on January 4, 1937, complaining of severe pain in the right eye and head of two weeks' duration and of such severity as to keep him awake.

Examination revealed an intensely inflamed right eye, which was very hard, tension 90 mm. Hg (Schiötz). The pupil was dilated, and the cornea steamy. The iris was pushed forward until it almost touched the posterior surface of the cornea. The fundus could not be seen.

An iridectomy was performed, but because the eyeball still remained very hard, a posterior sclerotomy was also performed. A large amount of thin sanguineous fluid was released from the eye by the sclerotomy and a marked decrease in tension followed. No view of the fundus could be obtained. On January 7, 1937, a large hemorrhage into the anterior chamber occurred, followed by another two days later. Cold packs were used and calcium gluconate was prescribed. At the present time the hemorrhages are slowly becoming absorbed, and the patient sees light to the temporal side. Tension is still elevated. Physical examination is negative; blood and urine examinations are normal.

Discussion. DR. W. H. CRISP inquired how far back from the clear cornea the sclerotomy incision was made. He raised the question as to whether the incision had been made too far back so that the wound was occluded by the iris.

Dr. L. L. Davis reported that the anterior chamber deepened very definitely after the sclerotomy. A posterior sclerotomy made in advance of the iridectomy is often valuable in lowering tension.

Dr. Whitney Porter inquired whether there was any hemorrhage in the eye before operation.

Dr. H. Shankel replied that no view of the fundus could be obtained. There was no fundus reflex but the eye transilluminated well.

RECURRENT CORNEAL ULCERS

Mrs. L. M., aged 36 years, entered the hospital on December 9, 1936, with the complaint of a painful right eye of two weeks' duration. Examination revealed a large corneal ulcer, with marked conjunctival and ciliary injection. The pupil was widely dilated. Fluid passed into the nose readily upon syringing into the tear sac.

Dental examination and X-ray films were negative. Tonsillectomy was advised by the Ear, Nose, and Throat Department and this was performed on December 14, 1936. Examination in the medical department was entirely negative. Blood, urine, and the results of a serology examination were normal, and the basal metabolic rate was normal.

Atropine, 1 percent, and hot packs were used locally. An intensive series of typhoid inoculations was given over a period of 18 days. The dosage was increased from 25 million organisms to 85 million. There was no apparent change in the ulcer during this time. On January 11, 1937, a paracentesis was performed. This was repeated on January 13, 1937, and the ulcer began to heal. During the past two days, the eye has shown no improvement.

Discussion. DR. L. L. DAVIS reported that the patient gives a somewhat unusual history. She had a severe pain in the left elbow for a month before the appearance of the ulcer. Bacteriological examination of smears and cultures from the

ulcer are negative. The infiltration is very deep and for that reason a streptococcus or a pneumococcus was suspected.

Dr. W. H. Crisp said that some ulcers are hopeless from the beginning. Atropine sometimes has a damaging effect on the cornea without causing any dermatitis.

Traumatic ulcer

Mr. G. J., aged 57 years, came to the hospital on November 24, 1936, complaining of pain in his right eye of three or four weeks' duration. The right eye had been scratched by a tree branch on September 26, 1936. Examination revealed a large ulcer in the lower half of the cornea. This was cauterized with trichloracetic acid. Atropine and hot compresses were prescribed. Examinations in the Department of Medicine and in the Ear, Nose, and Throat Department showed no foci of infection. Blood and urine examinations and serology tests were negative. The eye showed no improvement and on November 28, 1936, intravenous typhoid (25 million) was given. This was repeated on December 4, 1926. On December 8, 1936, the ulcer was scraped and a paracentesis was performed. On December 10, 1936, the ulcer still stained and a delimiting keratotomy was done. This was reopened the following day and on December 28, 1936, the ulcer was healed. There was steady improvement without any staining until January 5, 1937, when the ulcer showed a recurrence. On January 8, 1937, another paracentesis was performed. Improvement was apparent until January 12, 1937, when the base of the ulcer showed a descemetocele. Paracentesis was repeated and on the following day the ulcer was smaller but there was an anterior synechia and the pupil was not dilated. All attempts at dilation of the pupil have been unsuccessful. The eye remains intensely inflamed and the ulcer does not heal.

Discussion. Dr. W. H. Crisp said in regard to chemical cauterization that carbolic acid and trichloracetic acid continue to penetrate in spite of neutralization. This is not true of nitric acid, which is more self-limiting. He recommended the use of wooden applicators which absorb a good deal of the cauterizing material and prevent extended action.

Recurrent ulcers due to burns

Mr. J. H., aged 27 years, reported at the clinic on December 21, 1936, complaining of a painful right eye. He had suffered a burn two weeks previously while experimenting with type metal which exploded. The lids were badly swollen and inflamed. There were marked conjunctival and ciliary injection and a large corneal ulcer. The patient had been using atropine and the pupil was widely dilated.

The ulcer was cauterized with trichloracetic acid. Fluid passed into the nose readily on syringing through the tear sac. Atropine was discontinued and 0.1-percent scopolamine was substituted. The use of hot packs was advised.

On the following day, the conjunctiva was touched with 0.2-percent silver nitrate and the ulcer was again cauterized with trichloracetic acid. On December 23, 1936, the ulcer was smaller and 5-percent dionin was instilled. On December 28, 1936, the ulcer was larger and 25 million typhoid organisms were given intravenously. The ulcer then healed satisfactorily and had disappeared by January 5, 1937, when a new ulcer appeared at the temporal side of the first one. This healed in a week's time but a third ulcer then appeared temporal to the second. There is now a marked dermatitis of the lids and the eye is acutely painful. The patient has had three intravenous injec-

tions of typhoid of 25 million organisms each.

Discussion. Dr. F. R. Spencer reported that he had seen the patient soon after he was injured. There was a large piece of metal adherent to the center of the cornea and another in the caruncle as well as many smaller pieces of metal in the cilia and eyebrows; a few small pieces of metal were in the left cornea and conjunctiva, which were superficially burned. There was a white eschar on the conjunctival surface of the right lower lid. The burns on the right eye were not deep enough to result in a neuropathic keratitis.

Dr. Whitney Porter said that the branching form of the corneal lesions suggested herpetiform keratitis to him. The sensitivity of the cornea is not always decreased in herpetic keratitis.

Dr. W. H. Crisp remarked that the ulcerated area may be intensely sensitive but that corneal sensitivity elsewhere may be reduced.

Edna M. Reynolds.
Secretary.

NASHVILLE ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

February 15, 1937

Dr. H. C. Smith, *chairman*

Expulsive hemorrhage

Dr. W. W. Wilkerson, Jr., reported that Mr. J. K., aged 72 years, apparently in excellent physical condition, consulted him with the history of failing vision in each eye for the past several years. This had been much worse in the past year. He gave no history of any general disease nor of recent illness. On examination vision in the right eye was the ability to detect hand movements at four feet, while in the left eye vision was 20/100-1. Tension in each eye was 18 mm. Hg (Schiötz). The lids were normal; conjunctiva and lacrimal apparatus showed no pathology; no pericorneal injection was noted, and the cornea was negative. The iris appeared to be normal, and the pupils reacted normally to light. No view of the fundus of the right eye could be had, and an indistinct view of the left fundus showed no pathology.

Having in mind a cataract extraction he advised a general physical examination and dental care. X-ray films of teeth were negative as were also the general physical condition, the sinuses, and the tonsils.

Under preparation for operation the patient showed no evidence of nervousness. A four-percent solution of butyn was instilled into the left eye for anesthesia. No difficulty was encountered in making an ordinary corneal incision. Immediately after the incision was made and before an iridectomy was begun, the lens shot from the wound. Dr. Wilkerson immediately removed the speculum and closed the lids, maintaining a firm but gentle pressure. Vitreous poured from between the closed lids and there followed a great profusion of blood. Without further examination of the eye, a firm pressure bandage was applied. The eye was dressed a week later and the wound was closed; the anterior chamber remained filled with blood for several weeks.

The patient has what appears to be a typical phthisis bulbi without any corneal scarring, or pain.

Fowler Hollabaugh,
Secretary-Treasurer

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NEUROLOGY, OTOLOGY, AND OPHTHALMOLOGY

Much has been written as to the virtues and vices of specialization. Aristophanes, the Greek comic poet, poked bitter fun at "rectum specialists." A generation ago the word "specialist" was taboo among many of the medical profession. This very proper and useful word, like the equally logical and practical term "optometrist," has often been so sadly abused in the shortcomings of those who applied it to themselves as to have earned contempt and resentment.

From so philosophical a student of medical science and medical practitioners as William Osler, the values and the dangers of specialization evoked two apparent extremes of praise and blame.

"The restriction of the energies of trained students to narrow fields in science" he says, "while not without its faults, has been the most important single factor in the remarkable expansion of our knowledge. Against the disadvantages in a loss of breadth and harmony there is the compensatory benefit of a greater accuracy in the application of knowledge in specialism, as is well illustrated in the cultivation of special branches of practice."

Yet on another occasion Osler remarked: "A serious danger is the attempt to manufacture rapidly a highly complex structure from ill-seasoned material. The speedy success which often comes from the cultivation of a specialty is a strong incentive to young men to adopt early a

particular line of work. How frequently are we consulted by sucklings in our ranks as to the most likely branch in which to succeed, or a student, with the brazen assurance which only ignorance can give, announces that he intends to be a gynecologist or an oculist. No more dangerous members of our profession exist than those born into it, so to speak, as specialists. Without any broad foundation in physiology or pathology, and ignorant of the great processes of disease, no amount of technical skill can hide from the keen eyes of colleagues defects which too often require the arts of the charlatan to screen from the public."

Osler pointed to the preventive against loss of perspective in a narrow field: "Against this there is but one safeguard —the cultivation of the sciences upon which the specialty is based. The student-specialist may have a wide vision—no student wider—if he gets away from the mechanical side of the art, and keeps in touch with the physiology and pathology upon which his art depends. More than any of us, he needs the lessons of the laboratory, and wide contact with men in other departments may serve to correct the inevitable tendency to a narrow and perverted vision, in which the life of the ant hill is mistaken for the world at large."

The highest qualities of mind and knowledge are required for the comprehensive practice of general medicine, above all in a community where opportunities for consultation with specialists are limited. Some unworthy representatives of the medical profession have not hesitated to claim special knowledge and skill in well-nigh all departments of medicine, labeling themselves according to the immediate need or desire of the patient. The purpose of the "universal specialist," of course, is to have as many lucrative strings as possible to his bow.

The common association of ophthalmology with otolaryngology, while honored by custom and free from the aspersions applied to the "universal specialist," has an economic basis and is chiefly a matter of anatomic propinquity rather than of scientific relationship. In the larger centers of population, the recent tendency among most of those who aim at thoroughness rather than mere acquisition of a lucrative practice has been to restrict their work either to the trilogy of the upper respiratory tract (most of the ailments of the ear being associated with that tract) or to ophthalmology. In the graduate student, the plan to prepare for such a limitation greatly facilitates Osler's recommendation to cultivate the sciences upon which the specialty is based, to keep "in touch with the physiology and pathology upon which his art depends."

Wise is the specialist who holds constantly in mind the fact that in the human body the health or disease of the part depends upon the health or disease of the whole and the welfare of the whole upon the welfare of the parts; that the activities and disturbances of one part, however remote, may influence the activities and disturbances of other parts.

The character of the services to be performed does not favor a conjunction of the specialties of neurology and ophthalmology in one person, although here and there such a combination is attempted. Yet a close intimacy between these two departments of medicine is highly desirable. With skillful planning, combined meetings of ophthalmologic and neurologic societies might be made beneficial to both groups. It is a fact of much significance that some of the most instructive observations in ophthalmoscopy have been made by neurologists.

In Europe the years since the World War have seen an important and widespread movement in the direction of closer

contact between neurologists and ophthalmologists and aurists. In a recent essay (Archives d'Ophtalmologie, new series, 1937, volume 1, page 289) Tournay has undertaken to record the progress of this movement and to trace the reasons for its existence. Several journals, in France, Italy, and Spanish South America, have been definitely devoted to oto-neuro-ophthalmology. Thus we have the Revue d'Oto-Neuro-Ophtalmologie, the Rivista Oto-Neuro-Oftalmologica, and the Archivos de Oftalmologia de Buenos Aires.

A first congress for the same purpose was held at Strasbourg in 1922 upon the initiative of Barré, Duverger, and Canuyt; and numerous other such assemblies have followed the example.

Thus we have seen for a while an exaggerated divergence stimulated by the need for specialization; and later a renewed convergence called forth by the necessity for comparison and correlation of scientific findings. It is not sufficient for the ophthalmologist to send patients for neurologic examination. He and the neurologist must confer, must exchange information, must synthesize their impressions. Tournay illustrates his concept with a diagram suggestive of the graphic representation of a chemical molecule; information flows reciprocally between neurology and otology, between otology and ophthalmology, and between ophthalmology and neurology.

Each group should understand thoroughly the significance of the facts of cerebral evolution: the primeval dominance of the olfactory system; the later prodigious extension of the neopallium, with preëminence of the auditory and visual senses and paths; and the establishment between these apparatuses of complex relationships without which man's ascent in the evolutionary scale would have been impossible.

Tournay cites the titles and subjects of many essays presented in recent years before the combined groups of neurologists, otologists, and ophthalmologists. These are classified as dealing with conditions based upon the anatomic relationships of (1) the fixed paths of the cerebrospinal nervous system, (2) the fixed paths of the vegetative nervous system, and (3) the circulating fluids of the blood vessels and the lymphatics as well as the stagnant fluid of the cerebrospinal tissue and its surrounding membranes.

Tournay decries the tendency of some scientific groups to devote themselves exclusively to presentation and discussion of cases. This method (he argues), while least fatiguing, and a safeguard against excess of theoretical debate, may prevent adequate critical study of underlying reasons and also of the relative value of technical procedures.

Over two thousand years ago Plato attributed to Socrates the following not yet outdated analysis of the problem of specialization: "I dare say that you may have heard eminent physicians say to a patient who comes to them with bad eyes, that they cannot cure the eyes by themselves, but that if his eyes are to be cured, his head must be treated: and then again they say that to think of curing the head alone and not the rest of the body also, is the height of folly. And arguing in this way they apply their methods to the whole body, and try to treat and heal the whole and the part together. Did you ever observe that this is what they say?"

W. H. Crisp.

THE 1937 ACADEMY MEETING

"The tumult and the shouting dies;
The captains and the kings depart:"

and the Academy lapses from its most hectic week of the year into as nearly a recessive period as that organization now ever indulges in. Only the indefatigable secretaries labor on, already busy prepar-

ing plans for the meeting a year hence. During the quiet period various committees are continually working on assignments of what might be termed extracurricular activities.

The membership always pulls out of Chicago with the feeling that this is probably the best of meeting places for our group. Centrally located, with adequate hotels, excellent transportation facilities, and offering an abundance of entertainment for wives and daughters, Chicago invariably attracts an unusually large group, to which rule this year's gathering was no exception.

As a guide for logical procedure in commenting on the various elements of the meeting, the chronological method is as serviceable as any. To those who arrived on Saturday to participate in Board examinations, many signs of preliminary activity were in the air, but things really began to move on Sunday, on which day the president's reception in honor of Dr. and Mrs. Lee W. Dean and the honor guest, Dr. Harris P. Mosier, and Mrs. Mosier was held. This was an unusually felicitous occasion. The reception hall was of just the right size and was well arranged for the purpose and tastefully decorated. Numerous small tables and sufficient chairs were provided so that many were tempted to linger over the refreshments beyond the usual reception period. The result was a pleasant and easy informality that cannot be attained while balancing a cup of punch in one hand and a sandwich plate in the other. Hence all had a very enjoyable hour which, parenthetically, cannot be written truthfully of many receptions.

After this pleasant induction, the membership turned out in great force for the program of Monday morning. The papers of the president and guest of honor deserve more than the passing comment that is possible here. Both of these men can be relied on to talk sound common sense, enlivened with humor, and they ran true to form. Those who read their addresses in the Transactions will be well repaid.

The symposium on physiotherapy followed these papers—a fertile field this, of which the ground has been only scratched.

Monday night about seventy-five members attended the Teachers' Section. This department has been functioning for five or six years. It should be a wide-awake, vital section in the Academy, because the subject of the training of ophthalmologists and otolaryngologists is one of the most important problems of our specialty today. For some reason, however, this section hasn't quite found itself. Admittedly the subject is exceedingly involved and much deliberation is necessary before recommendations can be made, but it would seem that a clearer definition of the purpose of this section should be given and a program for accomplishing it be outlined. To be sure, something has already been done, but recommendations with regard to graduate teaching have not been forthcoming. Perhaps the answer for this section would be an organization somewhat along the general lines of the Academy; namely, a long-term executive secretary and a rotating committee of eight or ten with new appointees each year to replace two retiring members. This would give continuity to the effort and might render the section more productive.

The teaching courses were splendid—but three days is enough. Four days drain the teaching group too heavily, necessitate the introduction of relatively unimportant subjects, and spread the attendance too thin. By the fourth morning half the membership had left, and many courses were attended by only three or four. This is too discouraging for a teacher who has probably spent six months preparing his subject. It will be

a long time before he can be induced to prepare another course.

Each man is obviously limited to only a few courses; hence comment on the individual hours has to be extremely limited; but if the general quality can be fairly estimated from a few, it was excellent indeed. Where else than at the Academy could one have a demonstration in six hours of many practical points in prescribing bifocals and lenses for anisometropia, so that they shall be most effective optically; see amazingly lifelike colored photographs of the fundus, now possible of production by those skilled in this art; learn the latest technique about the application of radium; and have presented much of importance about plastic surgery? This last course is one that could well be expanded into something similar to the course in pathology. One nine-hour course could very profitably be occupied in outlining some of the more elementary matters, and a second more advanced course of the same length be provided for those who were prepared for it. There is a real need for such courses, and the attendance at the lectures on plastic surgery offered this year would indicate that they would be very popular.

Exhibits were up to the usual standards. The commercial are important and essential parts of the convention; the scientific are too similar from year to year and too much like those shown at the A.M.A. to be repeated annually. Probably an exhibit every third year would be sufficient.

Worthy of special comment was the Thursday evening entertainment. There was a splendid orchestra and an excellent floor show. The banquet on Wednesday was the success that it always proves.

Washington was chosen for the next meeting, and with great good judgment the council selected George M. Coates of Philadelphia as president-elect.

Lawrence T. Post.

BOOK NOTICES

OUTLINE OF OCULAR REFRACTION. By J. T. Maxwell, M.D. Cloth-bound, octavo, 407 pages, 135 illustrations. Omaha, Douglass Printing Company, 1937.

Since the "Accommodation and refraction of the eye" was published by Donders in 1864, the subject of refraction has been accorded a most important chapter in every complete textbook on ophthalmology, or diseases of the eye. Beside this, a large group of books has come into existence devoted entirely to the subject of refraction. Each of these books has been written by a new author, viewing the subject from his individual standpoint; and each gives its readers some understanding and information about the subject that he is unlikely to get from any other. One who wishes a full acquaintance with the subject will need to read widely, from Newton's "Opticks" to this latest claimant to attention. The standpoint of this author is stated in the first sentence of his preface: "This textbook is the result of twenty-five years' experience in the correction of errors of refraction." It is also a result of much reading, not only in medical literature but also in mathematical optics; and some in the by-ways of optometric propaganda. This is shown by the references appended to each chapter, as suggestions for collateral reading.

The book is especially valuable because its "applied optics" is given in diagrams, 34 geometric figures, instead of algebraic formulas. Diagrams speak a universal language. Algebra has a special language, foreign to ordinary life, and only serviceable to the person who is constantly working with it. The chapter on "Applied optics," is, perhaps, the best introduction we have to mathematical optics, as set forth in Cowan's "Ophthalmic optics." These diagrams might be criticized for the small

letters used in explaining them, and in a few the arrangement of lines is not so easily recognized as it might have been. But the student can easily draw his own diagrams, and so fix in his mind their true significance.

"Ocular physiology" is the subject of chapter 2, 66 pages. It begins with points of minute anatomy that need comprehension so that one may understand the functions thereafter explained. The accommodation of the eye is analyzed and explained in a way that brings out the importance of this function. Binocular vision, the subject of a special section, is given 30 pages. Chapter 3, 28 pages, is given to the trial case and accessories; and includes test cards and the machines that are designed to supplant trial frames and lenses. Chapter 4 gives "Aids to greatly reduced vision," including telescopic spectacles, magnifiers, pin-hole spectacles, and contact glasses. Chapter 5, "Anomalies of the dioptric system," discusses hyperopia, myopia, astigmatism, anomalies of accommodation, anisometropia, aphakia, and aniseikonia. Chapter 6, 50 pages, is devoted to muscular imbalance, a subject closely related to errors of refraction. The subject is brought vividly up to date by pictures of the recent apparatus with which the manufacturers would replace knowledge by elaborate machinery. It is appropriate as emphasizing the close relation of phorias and tropias with errors of refraction. Chapter 7, "Retinoscopy," supplements the usual descriptions of the shadow-test with those of "streak retinoscopy" and "dynamic skiametry," introduced by those who cannot use cycloplegics. Chapter 8, "Ophthalmoscopy," with no illustrations, is followed by chapter 9, on "Perimetry," and chapter 10 on "Examination of the patient." Then there is an appendix of 44 pages, given to "Ophthalmic lenses and dispensing."

These matters may be outside the usual routine of the ophthalmologist. But they are so closely related to the perfect performance of the lenses he prescribes that he should be ready to recognize the reason for any failure to secure a perfect result. The pictures of expensive machinery and the latest refinements in lenses may discourage the country doctor from prescribing glasses to his patients. But he should be made to understand that these things are not essential to good correction of eye defects, and are often ignored by those who have a large ophthalmic practice.

Edward Jackson.

TRAMPING TO FAILURE. By Thomas Hall Shastid, M.D. Clothbound, 497 pages, many illustrations. Published by George Wahr, publisher to the University of Michigan, Ann Arbor. 1937.

Reviewing a book like this is a real pleasure. It was fascinating to read and is easy to say good things about. The evenings of the past week have been rendered very delightful because of it. The style is easy, the English superb, the tale engrossing, and the moralizing done so simply and earnestly that the reader cannot but be impressed; in truth, he must agree with every essential point.

Handicapped by physical weakness in early youth, there was established an inferiority complex that obviously colored greatly the whole of the author's life. Unbearably bullied as a youngster, until through strenuous exercise and training in boxing he was able to take care of himself, and further misjudged and badly used in the first college that he attended, he acquired certain qualities, sympathy for the downtrodden, and a great desire for international peace, likewise perhaps a somewhat defensive attitude. He was a tramp in two senses, physically in that no one locality suited him long, and intel-

lectually in that he had a great diversity of interests and traveled many scholastic roads. Of a most inquiring mind, he needs must know not only the what but the why. Not for him to know merely that the circle is divided into 360 degrees but why it is so divided? Is it difficult to understand that he found few teachers who could satisfy that kind of quizzing?

Wandering through many universities, acquiring degrees in law and medicine with honors, practicing in many places, until midlife mostly in small towns, he gives a marvellous description of the difficulties encountered because of the ignorance and cupidity of his patients and the hostility of his fellow practitioners. Amazing and fascinating stories are told. How one man could have had so many bizarre experiences is almost inconceivable.

A sufferer from recurrent thrombophlebitis, its source undiscovered for many years because of careless examinations by competent but too hurried physicians and finally discovered by one who really took time and pains to study the case thoughtfully, he naturally decries bitterly the rush examinations of the successful doctors. The popular physicians have too much to do, the unknown, though perhaps more competent, not enough.

He briefly summarizes the optometry situation by stating that the optometrists are rapidly recognizing the need of better training; more and more time and education is being required by them. Soon this will be so much that they will say, "If all this, why not a medical education instead?"

And now for what is probably the underlying purpose of the book: Hinted at in the early chapters and strongly emphasized in the last third of the book is the author's plan for peace which he has entitled, "The war check vote."

The idea in brief is that by a constitutional amendment the right of engaging in war outside of the United States shall not as now be vested in Congress but in a referendum of the people. He shows conclusively that it is predatory interest, not the voice of the people, that forces war. It is an excellent idea; is not pacifism and advocates nothing against defensive war. It is to be hoped that his book will advance his plan. He also urges an amendment that shall prohibit Government loans to foreign countries without a referendum of the people, "The loan check gift vote."

Don't fail to read this interesting and valuable book.

Lawrence T. Post.

CORRESPONDENCE

Corrections of Col. Wright's Articles*

September 20, 1937

To the Editor,
American Journal of Ophthalmology,
Sir:

In my lectures on Cataract and Glaucoma published in your issues January to June this year, there are a number of errors in the text, for which circumstances necessitating the submission of a hurriedly prepared manuscript are largely accountable. That they are not more numerous is due to the kind offices of your editorial staff. Your readers will no doubt recognize and make allowances for mistakes which give rise to difficulties in perusal, but do not seriously affect the gist of the presentation, so that it is undesirable now for me to suggest their rectification.

There are, however, a few places where corrections of the text are necessary. Would you favour me by their publication.

Lectures on Glaucoma. No. 1.
Vol. 20, No. 5, May, 1937.

* For lack of a permanent address while he was on tour, Col. Wright could not be reached with galley proof for prepublication corrections of these articles.

Last line, page 462. The paragraph starting "This type" and ending "vascular-bed" on page 463 should read:

"The posterior-segment types of primary glaucoma offer a number of problems for the research worker, but the clinical observer sometimes tries to simplify matters by thinking of two main modes of increased volume pressure of the posterior segment, viz.; those associated with the aqueous secretion and vitreous body, and those associated with the vascular bed."

Page 466, col. 2, line 6. For "either" read "other."

Page 468, col. 1, the paragraph commencing "Prima facie" and ending "vitreous-body type" line 9, col. 2, same page should read:

"Prima facie we might consider that decompression ought to be effective in: (a) glaucomas of an anterior-segment type, such as, early congenital glaucoma or glaucoma simplex; (b) glaucomas of a posteror-segment vascular-bed type—combined with therapy directed towards the relief of intermittent vascular-bed phenoma; or (c) glaucoma of the epidemic-dropsy group (hydrops)—pending removal of the cause: and less effective in primary glaucoma of a posterior-segment vitreous-body type."

Lectures on Glaucoma. No. 2.

Vol. 20, No. 6, June, 1937.

Page 577, col. 2, line 14. The portion commencing "unless" and ending "we do" (line 18) ought to read: "unless—as is probable—you have to contend with vascular-bed types and the influence of the vascular mechanism more often than we do."

Page 579, col. 2, line 12. For "it" read "trephining."

Line 18 after "policy" use a comma and for "I refer" to the end of the column read: "but the necessity for continued massage and miotics for prolonged periods indicates that further anterior decompression is required, unless steady obliteration of the anterior chamber renders an alternative more desirable; for example, cyclodialysis."

Yours faithfully,

(Signed) ROBERT E. WRIGHT

NOTE

The Ophthalmic Publishing Company has exhausted its supply of the issue of January, 1937. In order to have copies available for future demands, the Company will pay $1.50 for any copies of this issue that may be obtainable from its subscribers.

THE OPHTHALMIC PUBLISHING COMPANY
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ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is only mentioned in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Malbran, Jorge. **Glassy striae in the anterior chamber.** Arch. de Oft. de Buenos Aires, 1937, v. 12, Feb., p. 85.

In addition to the nine cases previously recorded the author reports and illustrates two cases of free glassy striae in the anterior chamber. One was due to a metaherpetic keratitis and was unilateral, the other was observed in a case of heredoluetic interstitial keratitis and was bilateral. The pathogenesis of all cases thus far reported is explained by the hypothesis of Lehmann, Urrets Zavalia, and Obregon Oliva, namely, that folds or tears of Descemet's membrane, of either traumatic or inflammatory origin, are the primary cause and that abnormal proliferation of the endothelium with formation of a glassy substance to cover the tags and fibrin threads is a secondary involvement.

M. Davidson.

Mecca, Mario. **A contribution to the study of Fuchs's heterochromia.** Ann. di Ottal., 1936, v. 64, Dec., p. 825.

Difference in color of the irides, precipitates on the posterior surface of the cornea, and cataract are the distinctive symptoms of this condition. In twenty cases of Fuchs's heterochromia and five of the sympathetic type, the author studied the biomicroscopy of the cornea, aqueous, iris, lens, and vitreous. The researches lead to the very probable conclusion that Fuchs's heterochromia is merely a slowly regressive form of serous iridocyclitis and therefore not of sympathetic origin. General examination makes it almost certain that about fifty percent of these cases have a tuberculous etiology. The heterochromia is therefore secondary to a chronic local inflammation of the iris. (One plate, 6 figures, bibliography.)

Park Lewis.

Mossa, Giovanni. **The genesis of choroidal colobomata.** Rassegna Ital. d'Ottal., 1937, v. 6, Mar.-Apr., p. 145.

Mossa believes that the two principal theories of the genesis of choroidal colobomata, the fissural and the inflammatory, suffice to explain most cases. Typical colobomata may be subdivided into definitely congenital and those certainly of inflammatory origin. Between these two are intermediate forms. In the former there is very little pigment and there are usually associated congenital ocular defects. They also show an elevated threshold of retinal sensitivity to light. Inflammatory coloboma is considered atypical and independent of hereditary factors. A third type of coloboma is due to arrest of development, which is not necessarily of inflammatory origin but above all is a phenomenon of recessive character. The author suggests that we

speak of the typical coloboma, not as related to the fetal fissure, but as a hereditary defect. Four cases are reported. (8 figures.) Eugene M. Blake.

Nakamura, B., and Uchida, Y. **Prophylactic procedure for sympathetic ophthalmia.** Graefe's Arch., 1937, v. 137, pt. 2, p. 233.

In 1923 the authors recommended treatment for tuberculosis in penetrating injuries of the eye where sympathetic ophthalmia was feared, particularly in case the injured eye retained more or less useful vision. Between January, 1932, and May, 1936, 95 cases of perforating ocular injury were chosen at the Osaka eye-clinic for this prophylactic treatment. All presented the following features: two weeks after the injury pronounced inflammatory signs, more or less serious injury of the ciliary body, perforating injury with subsequent iridocyclitis, sympathetic irritation in the fellow eye, tuberculin allergy. The prophylactic treatment was that regularly employed in ocular tuberculosis, namely a weekly subcutaneous injection of 1 c.c. of A-0 no. 1, and every other day an intramuscular injection of 3 c.c. of three percent calcium iodide. Of the A-0, one injection was administered to each of 5 patients, 2 to 24, 3 to 16, 4 to 14, 5 to 9, and 6 to 10 injections inclusive to 18 patients. In none of the 95 cases did sympathetic disease occur. On the other hand, among 139 cases with comparatively mild symptoms after injury none of whom received the prophylactic treatment, 9 cases of sympathetic disease occurred. Detailed tabulation of the 95 and 139 cases are appended. H. D. Lamb.

8

GLAUCOMA AND OCULAR TENSION

Hausmann, Gertrud. **On the permanent results of cyclodialysis.** Zeit. f. Augenh., 1937, v. 92, June, p. 139.

The permanent effects of cyclodialysis are discussed on the basis of utterances in the literature and the experience of the Meller clinic. Although the review of the literature is not exhaustive, the indications for operative treatment of glaucoma in several large clinics are given.

In the Meller clinic cyclodialysis is the first operation done in chronic glaucoma. In case of failure, a second cyclodialysis or some other operation follows. Of 326 patients operated on between 1920 and 1935, 105 could be reëxamined. In cases of secondary glaucoma after cataract and also with anterior synechia, and after chronic iritis in which iridectomy had failed, cyclodialysis gave a satisfactory result. In thirty-four cases of primary glaucoma in which cyclodialysis was the only operation, twenty-eight have satisfactory tension and vision. Of twenty-two patients with primary glaucoma in which a second operation followed cyclodialysis, only thirteen had a satisfactory result.

It is noteworthy that cyclodialysis has been followed by attacks of acute glaucoma in eyes that had been operated on for chronic glaucoma. Of fifteen cases in which cyclodialysis followed iridectomy, it was successful in thirteen.

F. Herbert Haessler.

Müller, H. K. **The mechanism of peeling-off of the lens capsule in capsular glaucoma.** Klin. M. f. Augenh., 1937, v. 98, May, p. 653.

The essence of capsular glaucoma consists in a degeneration of the lens capsule, which becomes brittle and shows concentric tears of the superficial layers. Through friction by the posterior surface of the iris the edges of the tears are rolled up and the capsular lamellae are peeled off. The detached pieces are visible as fine gray floccules at the pupillary margin. By obstructing the paths of outflow of the aqueous they produce increased intraocular tension. Hence capsular glaucoma is not a primary but a secondary disease. The author describes a case of capsular glaucoma in a man of 67 years on whose left eye a preparatory iridectomy had been performed ten years previously. The anterior surface of the right lens showed a central roundish opaque pupillary disc with whitish-gray partly raised indented margins, the typical picture in capsular glaucoma. The borders of the

opaque pupillary disc of the left eye corresponded to the keyhole pupil. From this it was concluded that the iris by rubbing on the surface of the lens produces the shedding of the capsular lamellae. For preventing peeling of the capsule in the absence of increased tension, the author recommends prophylactic quieting of the iris with mydriatics or miotics. (Illustrations.) C. Zimmermann.

Redslob, E. **Glaucomatous dissociation of the corneal epithelium.** Bull. Soc. Franç. d'Opht., 1936, v. 49, pp. 145-156.

In glaucoma the corneal epithelium suffers two changes. In the first the corneal surface is smooth, and clouding is diffuse, homogeneous, and transient, disappearing when the tension is lowered. In the second, the surface is irregular, covered with non-homogeneous "dew drop" changes enduring after the tension is lowered.

The first is not due to corneal edema as often supposed, but to displacement of the corneal layers from their proper positions with respect to one another, due to increased tension. The permanent opacities characterizing the second type were studied histologically in an eye removed because of absolute glaucoma due to carcinoma of the choroid. The principal change consisted of marked dissociation of the basal cells of the epithelium by fluid, with formation of large cavities.

Clarence W. Rainey.

Reid, A. C. **Atrophic recession of the lamina cribrosa.** Brit. Jour. Ophth., 1937, v. 21, July, pp. 361-363. (See Section 11, Optic nerve and toxic amblyopias.)

Robertson, J. D. **An investigation into the theories of the formation and exit of the intraocular fluids.** Brit. Jour. Ophth., 1937, v. 21, Aug., pp. 401-448.

The author elaborates the subject under the headings of historical, experimental, and discussion with a summary setting forth the secretory transudation, and dialyzation theories. Argument favoring dialysis for production of the intraocular fluids is found unconvincing. The author does not accept proof of chemical equilibrium between blood and aqueous humor; or of physical equilibrium between blood and aqueous. He denies that the equilibrium of intraocular pressure is maintained by the hydrostatic force in the capillaries less the difference in osmotic pressure between the aqueous and blood. In his opinion the formation of aqueous humor is due to a process of secretion at the ciliary body, the fluid moving forward to the angle of the anterior chamber and being actively absorbed into the canal of Schlemm by some process other than osmosis. (References.)

D. F. Harbridge.

Saint-Martin, M. **Cyclodialysis; technique, prognosis, indications.** Bull. Soc. Franç. d'Opht., 1936, v. 49, pp. 157-172.

The author reports upon a series of cases of all forms of chronic glaucoma treated by means of cyclodialysis. The conjunctiva is dissected vertically over the external rectus muscle. The insertion is grasped for fixation and a 3 mm. vertical scleral incision is made with a keratome, in advance of the tendon, 5 or 6 mm. from the limbus. An Elschnig spatula disinserts a quarter or third of the ciliary body. The author reports persistent hypotonic effect in 82 percent of 74 cases, improvement of vision in 28 percent, stationary vision in 28 percent and lowered vision in 43 percent. Clarence W. Rainey.

Sanctis, G. E. de. **The action of doria on the normal and the glaucomatous eye.** Ann. di Ottal., 1937, v. 65, Jan., p. 25.

Doria is one of the cholin derivatives. (See Amer. Jour. Ophth., 1936, v. 19, p. 269.) The author reviews the published work on this and its analogues, acetylcholin and accholin, and on its effect on the normal eye under carefully observed conditions, with measurements of the pupil, duration of action, and so on. It is especially efficacious in chronic simple glaucoma. In one instance, one hour after its instillation tension was reduced from 75 to 30 mm. Hg, a diminution of 45 mm. The dilatation of the pupil was reduced during

the first hour from 3 to 1.5 mm. This was maintained for two hours with gradual increase in tension. The original high tension was not reached for fifteen hours. After its application on the second day a tension of 75 mm. was promptly reduced to 25 mm. Hg and so retained for five hours. The original pressure was not again reached for seventeen hours. Like results were obtained for six days. Instillation of the drug was followed by slight pain and moderate hyperemia.

In a case of hemorrhagic glaucoma with a tension of 90 mm. the pupil was reduced to a diameter of 1 mm. without in any degree lessening the intraocular pressure. The effect was attributed to the action of this drug on the intraocular vascular system favoring the flow of fluids and inhibiting the action of the ciliary epithelium. (Bibliography.) Park Lewis.

9

CRYSTALLINE LENS

Angius, Tullio. **Disc-like opacity of the lens with circumscribed opacity of the cornea.** Rassegna Ital. d'Ottal., 1937, v. 6, Mar.-Apr., p. 168.

Following a rather severe blow to the left eye by a candle, a nine-year-old girl presented corneal, iridic, and lenticular changes. The slitlamp revealed typical corneal edema from rupture of Descemet's membrane. The opacity was disciform and about 3 mm. in diameter. It involved the deeper stroma and there were endothelial changes. In a zone corresponding to the diameter of the normal pupil many fine brownish pigment granules were seen upon the anterior capsule of the lens. In the same zone one saw a superficial opacity of the lens of a milky-gray color, composed of alternating opaque striae and clear bands. Six weeks after the injury the biomicroscope showed complete transparency of the dioptric media and slight depigmentation of the pupillary margin. Vision was normal. The author gives a good review of Vossius' annular opacity and Colombo's disc-like opacity of the lens. The pathogenesis and pathology are discussed and the literature reviewed. Eugene M. Blake.

Borsotti, Ippolito. **Contribution to the study of lens-antigen therapy.** Ann. di Ottal., 1936, v. 64, Nov., p. 744.

In order to demonstrate the least possible influence that lens-antigen therapy can have in accelerating the resorption of the lens matter of residual cataract, the author endeavored to make as nearly identical as possible the condition of the animals used in the experiments and in the controls. He introduced into the anterior chamber of rabbits a given amount of the lens substance from others of the same species, and in others bovine lens matter without involving the lens of the animal itself. He compared the period of resorption of lens substance with that in controls in which a corresponding amount of bullock lens had been injected prior to, contemporaneously, and subsequently to that used in the experimental animals. He found that lens matter injected at the time or shortly after that used in the experiments had no effect on rapidity of resorption but in some instances seemed to retard it, yet had shown a favorable influence in modifying or preventing reactive phenomena. On the other hand, injection at least two weeks prior to the experiment hastened resorption of the lens matter but also gave rise to a reaction so violent that it could be considered an anaphylactic phenomenon. (Bibliography.) Park Lewis.

Bücklers, Max. **Filiform cataract.** Zeit. f. Augenh., 1937, v. 91, Apr., p. 338.

In a brother and sister of fourteen and eight years respectively, similar bilateral cataracts of unusual structure were observed. In each, the entire lens was swollen and transformed into a tangled mass of fibrillar coagula and clefts. The familial occurrence in a family with multiple consanguinity and phenotypic normal parents suggests a recessively congenital lesion.

F. Herbert Haessler.

Favoloro, G. **Embryonal and fetal central cataract.** Ann. di Ottal. 1936, v. 64, Nov., p. 721.

The author describes four cases of congenital cataract which have retained

their embryonal origin. The first is a rare form of hard nuclear cataract, the second, third, and fourth represent three forms of central zonular cataract. The embryonal cataractous processes may remain distinctly localized, determining the embryonal origin or equally clearly showing later fetal involvement. These distinctions may remain through postnatal life unchanged or they may pass through the embryonal, the fetal, and the perinuclear phases, becoming as in the fourth case complete, and each phase being definitely evident through biomicroscopy.

The author after reviewing the work of other writers believes that these diagnostic differences exist and should be recognized much more frequently than they are today in congenital cataract. (One plate, 6 figures, bibliography.) Park Lewis.

Federici, Ermanno. **Roentgen rays in epitheliation of the anterior chamber and in delayed recovery of operative wounds after cataract extraction.** Boll. d'Ocul., 1937, v. 16, Jan., pp. 112-125.

The history is given of five patients, three female, their age varying from 57 to 65 years, who at slitlamp examination showed a semitransparent newformed tissue entering the anterior chamber above and covering the anterior surface of the iris or the posterior surface of the cornea. The examination was made 5 months, 50 days, a year, 25 days, and 15 days respectively from the date of operation. The operation had been performed uneventfully in some and with an operative mishap in other cases. Some had low tension, some showed symptoms of iridocyclitis and glaucoma. Roentgen therapy gave good results in almost all these cases, and also in one case in which a traumatic cyst had been removed from the anterior chamber. The epithelial membrane disappeared in some cases, and in others it was changed into a thin opaque scar tissue. The writer concludes that roentgen therapy if applied early may save some eyes that otherwise would have to be enucleated; and that it favors healing of the wound after cataract operation in similar cases. When the new-formed tissue has lined the entire chamber this therapy may destroy the new tissue but cannot save the eye from such a sequel as adhesion of the iris to the posterior face of the cornea by organized exudate. (Bibliography.) M. Lombardo.

Fontana, Giuseppe. **The action of dinitrophenol upon the eye.** Rassegna Ital. d'Ottal., 1937, v. 6, Mar.-Apr., p. 113.

The author has studied the effects of dinitrophenol upon rabbits' eyes, using therapeutic and toxic doses. The animals were studied regularly with the biomicroscope during the experiments, but no changes could be observed. Finally, the eyes were studied histologically for changes in the optic nerve and retina, employing Marchi's stain; but here again there was complete absence of pathologic changes.

Eugene M. Blake.

Goldmann, Hans. **Studies about adult-nucleus streaks of the lens.** Arch. f. Augenh., 1937, v. 110, July, p. 405.

The adult-nucleus streak consists of a reflex zone several layers thick which often can be dissolved into elementary streaks and analyzed with the aid of the arclight-slitlamp. The thickness of the streak increases with age. Whereas at the age of 20 we find only 3 or 4 streaks, at the age of 80 there are 20 elementary streaks present, thus one elementary streak forms every two to three years. These streaks may be grouped according to color, luminosity, and thickness into three groups each belonging to a distinct age-period. The streaks that form up to the age of 20 years are weakly reflecting and distinctly yellow, those that form during the third and fourth decades are brightly reflecting and yellowish, and those that form with the beginning of the fifth decade are white. R. Grunfeld.

Hradecka, Jr., Joachim, J., and Kodicek, E. **Biochemic changes in organs.** Ceskoslovenska Ofth., 1937, v. 3, no. 1, pp. 38-44.

In rabbits made to develop cataract, the ascorbic acid and glutathione con-

tent are reduced in the kidneys, liver, spleen, and brain. In normal control rabbits considerable variation is shown in glutathione content, but much less in ascorbic acid. Following naphthalene poisoning no especial changes are found in the ascorbic-acid content of organs. Large doses of ascorbic acid, given simultaneously with naphthalene, have no effect on the ascorbic-acid content of organs.

In naphthalene poisoning, examination shows no increased catalytic oxidation of ascorbic acid. Alteration may possibly occur in the barrier between the aqueous humor and the blood. Naphthalene poisoning may perhaps lower the glutathione content as a first effect, followed by other changes in the ascorbic acid of the body. Glycemia is not changed under naphthalene poisoning. G. D. Theobald.

Hradecka, J., Joachim, J., and Kodicek, E. **Biochemic changes in the eye tissues.** Ceskoslovenska Ofth., 1937, v. 3, no. 1, pp. 29-37.

In the adult rabbit these writers agree with other authors in that three hours after the first does of naphthalene the ascorbic acid in the aqueous humor is lessened, and it continues lessened throughout the experiment. In the lens the glutathione is considerably diminished, ascorbic acid slightly less. Intraocular and subconjunctival injection of highly concentrated solutions of ascorbic acid did not prevent cataracts from developing. Ascorbic acid in tablet form was given to nine patients in whom senile cataracts were forming. After eighteen months there was no great difference in development of the cataract in patients treated and those not treated. G. D. Theobald.

Nastri, Francesco. **Behavior of the chlorides in the aqueous and blood in parathyroid cataract.** Rassegna Ital., d'Ottal., 1937, v. 6, Jan.-Feb., p. 19.

Nastri removed the parathyroid gland from rabbits and studied the percentages of chlorides and the appearance of opacities in the lenses. He was unable to determine any real change in the amount of chlorides, in either the blood or the aqueous, and feels that in this endocrine disturbance the formation of cataract is not related to the percentage of chlorides. Eugene M. Blake.

Rollin, J. L. **Cataract with neurodermia.** Zeit. f. Augenh., 1937, v. 92, May, p. 16.

Rollin reports his study of two patients in whom cataract and neurodermatitis were associated. In one patient it was possible to demonstrate hypofunction of the thyroid gland. Therapy with thyroid preparations improved the visual acuity and skin condition, but left the lenticular opacities unchanged. The entire skin was thickened and relatively inelastic on all the flexor surfaces, and throughout there were scratch marks and epithelial defects. (In the other patient an asthmatic condition prevented metabolic study.) All the lens capsules were smooth and clear.

The right lens of the first patient had a very thin, barely perceptible zone of clear lens beneath the capsule and under this an equally thin stratum of delicate homogeneous opacity. Behind this was a wider zone of clearing in which were extremely delicate fairly closely packed disciform grayish-white opacities. The deeper layers were clear. In the left eye the opaque zone was directly subcapsular and had a silky luster and partly whitish crystalline scintillating opacity with radiating bands that suggested a stellar figure. The deeper layers were less dense, grayish, and almost homogeneous. Nowhere were there colored elements. In the other patient the lenses were not significantly different.
F. Herbert Haessler.

10
RETINA AND VITREOUS

Borsotti, Ippolito. **A case of tapetoretinal degeneration (atypical retinitis pigmentosa).** Rassegna Ital. d'Ottal., 1937, v. 6, Jan.-Feb., p. 30.

The patient described was a girl of twenty whose vision had begun to fail at the age of ten years. The nerveheads were contracted, clear cut, oval, and waxy; arteries and veins greatly reduced in caliber and uniform. There

was almost complete depigmentation of the retina, but toward the periphery there were a few elongated filamentous masses of pigment. The macular region was occupied by an area of peculiar greenish degeneration, with fine pigment granules.

The case is considered to be one of tapetoretinal degeneration with peripheral and macular sites. Accurate examination of all the symptoms observed would seem to indicate that there were two atypical pictures, one of retinitis pigmentosa and one of progressive familial degeneration of the macula. The author feels that the second picture (syndrome of Stargardt) possessed individuality only in a clinical sense, since both pictures represent a common degenerative process. (2 figs., colored plate, careful review of literature.)

Eugene M. Blake.

Czukrasz, Ida. **Angiogliosis retinae with report of two cases.** Brit. Jour. Ophth., 1937, v. 21, July, pp. 368-377.

While the disease discussed usually appears in childhood, adults also are often afflicted. The fundus changes, the presence of hemorrhage, the development of glaucoma, and the total loss of sight are the four stages of the disease enumerated. Radium treatment, when begun in early stages, is found effective. After glaucoma, enucleation is indicated. The two cases presented are those of boys aged eight and eleven years respectively. It is the opinion of the author that these tumors are ectodermal in origin with the initial cause lying in the neuroepithelium. He also feels that the two cases presented offer convincing proof that angiogliosis retinae is different from angiomatous tumors. (9 figures. References.)

D. F. Harbridge.

Fiore, T. **Is there a vitreous interchange?** Ann. di Ottal., 1936, v. 64, Dec., p. 865.

Various experiments have been made to determine whether the vitreous is a living and ultramicroscopic structural tissue or a gel. In the former case there must be a respiratory exchange of gases. Researches on vitreous removed from the living eye, to determine whether this interchange takes place, were negative. It is well known that the energy necessary for the living tissue may be provided by anoxybionic processes of which the principal is the breaking down of glycogenic substances into lactic acid. The experiments of the author were made in order to determine whether respiratory interchange took place in the vitreous in the presence of monosaccharids or amino-acids and if the vitreous had power to excite glycolytic activity such as is found in the embryonic lens in high degree.

Various experiments on the vitreous of the living rabbit, after the method of Warburg, lead the author to conclude that while there is not a true oxygen interchange the vitreous has in itself an enzyme which provokes dehydrogenation of substances capable of functioning as donors of hydrogen. The origin of this enzyme may be in other ocular tissues from which it reaches the vitreous. (Bibliography.)

Park Lewis.

Gallenga, Riccardo. **The genesis of spherical opacities of the vitreous—a case of synchisis aurea.** Rassegna Ital. d'Ottal., 1937, v. 6, Jan.-Feb., p. 85.

The author presents a good review of our knowledge, or defects in knowledge, of the spherical opacities of the vitreous. He then reports the case of a forty-year-old woman whose left eye was practically blind. Corpuscles of a golden yellow color were present in the aqueous, the iris was partially depigmented and tremulous, the pupillary borders notched. A great number of spherules of golden yellow color were uniformly distributed through the vitreous, which was explorable with the slitlamp. The spherules were perfectly round, practically uniform in size, and trembled with movements of the globe, giving the impression of a boiling fluid. Chemical study of some of the aspirated vitreous was negative for albumen, urea, tyrosin, and cholesterin. Phosphates and chlorides were demonstrated. The spherules contained sodium and calcium.

Eugene M. Blake.

Handmann, M. **Retinitis circinata in the stage of intense development.** Klin. M. f. Augenh., 1937, v. 98, May, p. 618.

In an otherwise healthy woman of 49 years with retinitis circinata, observed from the incipient stage for five years, very large white degenerative surfaces developed in the retina. In accordance with the first description by E. Fuchs these must be considered as the rare final stage of retinitis circinata, because the aspect of the retina in many respects deviated from that of retinitis exudativa (Coats). As it was possible to observe the process clinically from the first stage the diagnosis of retinitis circinata was assured. Thus, again uncomplicated old cases of retinitis may lead to extensive heavy exudations in the posterior layers of the retina, if the disease has a period of several years for its development. C. Zimmermann.

Hartinger, H. **Correction to "A simple aid for diathermic treatment of detachment of the retina" by M. Pagani,** (Klin. M. f. Augenh., 1937, v. 98, p. 210). Klin. M. f. Augenh., 1937, v. 98, April, p. 533.

The apparatus was manufactured by Carl Zeiss, Jena, in coöperation with the inventor of the method, Prof. Stampelli of Rome, and was demonstrated in 1936 before the German Ophthalmological Society at Heidelberg. C. Zimmermann.

Koyanagi, Y., and Kinukawa, Ch. **Similar changes of the retinal pigment epithelium and the renal tubular epithelium in various poisonings.** (Contribution to . . . retinitis albuminurica) Graefe's Arch., 1937, v. 137, pt. 2, p. 261.

In rabbits, after injection of septojod, naphthalin, mercuric chloride, uranium, guaiacol, nephrotoxin, lienotoxin, and hepatotoxin, similar degenerative changes were found in the retinal pigment epithelium and in the epithelium of the kidney tubules. In albuminuric retinitis the retinal pigment epithelium is primarily affected by the same toxic influences that cause the nephrosis. In other words, there is no retinitis albuminurica without nephrosis. H. D. Lamb.

Lindner, K. **Clinical study of the vitreous. The vitreous and retinal detachment.** Graefe's Arch., 1937, v. 137, pt. 2, p. 157.

Lindner believes that the retinal tear from dragging occurs only in fixing the eye or through turning the eyeball about its center, and not through parallel movements of the eye in space. The residual, freely movable mass of the vitreous after its contraction remains behind because of inertia in fixation of the eye, and thus drags at the most posteriorly located places of adhesion between vitreous and retina, causing a tear in the latter. Choroiditis or retinochoroiditis has not previously been present. In eyes with retinal detachment, an altered interchange of fluids causes further contraction of the already detached vitreous.

Liquefaction of the vitreous usually begins in the center of the vitreous and gradually increases posteriorly, leaving frequently a thin layer of the vitreous on the retina. A spontaneous tear in the retina is less likely to occur from liquefaction of the vitreous than from its contraction and detachment.

The difficulty of being able to tell whether an empty space under the vitreous is an artefact can be avoided by the method of Szent Györgi. But, even with ordinary methods of fixation, changes in the detached hyaloid membrane may indicate a natural vitreous detachment. When the retina is drawn internally and its folds filled with coagulated fluid, accompanied by serous detachment of the choroid, the vitreous detachment was present before enucleation. A detached vitreous becomes liquefied and retinal detachment follows. The liquefaction may in time become so extensive that hardly any vitreous is left; and this explains the occasional spontaneous healing of retinal detachment. The vitreous appeared detached in twelve of the author's thirteen cases of spontaneous detachment and in fourteen of Salzmann's sixteen.

In the living, examination for vitreous detachment can be carried out best with the aid of the slitlamp, a monocular angled microscope, and a contact glass. H. D. Lamb.

Simon, C. **Retinal method of identification.** N.Y. State Jour. of Med., 1937, v. 37, Mar. 15, p. 577.

Retinal identification by means of photography has been simplified by the author, who also presents a new system of classification of retinal patterns. After the fundus is photographed, a transparent protractor is laid over the picture and readings are taken of veins in certain definite locations. These patterns never change. This method is to be used in addition to finger printing.
Theodore M. Shapira.

Slavik, B. **Stimulating therapy in pigmentary degeneration of the retina.** Ceskoslovenska Ofth., 1937, v. 3, no. 1, pp. 1-5.

At the Brno Eye Clinic, 1928-1935, thirty patients with pigmentary degeneration of the retina received stimulating treatment (milk and typhus vaccine). Central visual acuity improved in 12 of these patients; 7 were helped slightly; and 13 showed no results whatever. In case 1 vision improved from counting fingers at 4 m. right and 2 m. left to 6/15 in each eye, the effect lasting nearly three years; in case 2, from counting fingers to 6/20 right eye and 6/18 left eye, the improvement lasting eighteen months. The peripheral fields remained unchanged. During the induced fever, the patients complained of blurred vision which disappeared the following day and vision was improved over that recorded before treatment. Unless this reaction were produced, no betterment could be expected; when manifested, however, improvement was a frequent result. G. D. Theobald.

Uyama, Yasuo. **The characteristic structure of the retina of the human eye.** Graefe's Arch., 1937, v. 137, pt. 2, p. 318.

In the case of the horizontal cells of the retina, the author succeeded in staining the neurofibrillae which extend from one cell body to the other to form a continuous network. The so-called crystalloids in the horizontal cells are much more likely to be cholesterin crystals. The crystalloids lie close to the nucleus and have no direct connection with the intracellular neurofibrillae.

Two types of amacrine cells are present in the human retina, one globular or elliptic shaped and furnished with long processes, identified with the horizontal amacrine cells; the second type including smaller and more numerous cells which have the delicate neurofibrillae in spiral windings at one side of the cell-body. H. D. Lamb.

Weve, H. J. M., and Fischer, F. P. **The amylase of the subretinal fluid.** Arch. f. Augenh., 1937, v. 110, July, p. 390.

Having already proved the presence of amylase in the subretinal fluid and its origin from decomposed retina, the authors worked out a micromethod for its easier detection by use of the capillarisator principle developed by Grüss. They confirmed the presence of amylase in the subretinal fluid in each of the fifty cases of detached retina examined, with the exception of those in which the tear and the greatest extension of the detachment were situated above the horizontal line, and the specific gravity was below 1008. In each case they were able to rule out admixture of blood with the subretinal fluid by proving the absence of catalase. It was further noted that amylase is always accompanied by an equal amount of peroxydase, forming a simple compound, peroxydamylase. The action of amylase is frustrated in the presence of vitamin C, even in extremely weak dilution. R. Grunfeld.

11
OPTIC NERVE AND TOXIC AMBLYOPIAS

Aubaret, E., and Farnarier, G. **Varicosities of the papilla.** Arch. d'Opht. and Rev. Gén. d'Opht., 1937, v. 1, n.s., Apr., p. 304.

Within a two-year interval a sailor of 48 years suffered two episodes of acute amblyopia of the right eye. It was discovered that the trunk of the central veins was enormously dilated, with small hemorrhages in the immediate neighborhood. A venous loop extended

toward the temporal side of the disc and into the vitreous, and from it small venous twigs arose. Because this anomaly had not been present two years before, the authors conclude that thrombosis had occurred in the central vein and that new vessel formation had then developed. (Bibliography.)

Derrick Vail.

Heuven, J. A. van, and Fischer, F. P. **The water-binding of the brain.** Brit. Jour. Ophth., 1937, v. 21, July, pp. 352-360.

In an article not lending itself to abstract the authors, by means of schedules, demonstrate their findings as to water-binding of the brain. Fresh brains of the ox were used in the experiments. The capacity, intensity, and form of the water-binding are quite like those of the optic nerve demonstrated in an earlier paper by the same authors. Conditions influencing the brain also reveal changes in the optic nerve. (2 diagrams, 7 schedules.) D. F. Harbridge.

Holmes, Gordon. **The prognosis in papilledema.** Brit. Jour. Ophth., 1937, v. 21, July, pp. 337-342.

In many cases operation for papilledema should not be rushed into but delayed, because complete removal of the tumor is often impossible, and there is too great a risk to life especially where definite localization is not possible. Symptoms indicating the need for operation include swelling of five or more diopters, heavy engorgement of the retinal veins, decrease in caliber of arteries in the swollen disc, increasing greyness and density of the disc, and beginning constriction of the visual field, especially peripheral contraction. Some patients also complain of a fleeting vision. Occasional progressive failure of vision after operation occurs particularly in cases in which the visual fields have become seriously constricted, although two cases cited were in patients with unrestricted visual fields.

D. F. Harbridge.

Reid, A. C. **Atropic recession of the lamina cribrosa.** Brit. Jour. Ophth., 1937, v. 21, July, pp. 361-363.

The author likens the eyeball to a tennis ball as to equilibrium and center of pressure. It is stated that there are many needless operations in these cases based on the misconception that there will eventually be a raised tension resulting in damage to sight. The purpose of the paper is to demonstrate that the atrophic recession is not simply physical effect of pressure alone, but that it may be associated with disturbance of the blood supply of the glia (central artery) and of the lamina (circle of Haller). D. F. Harbridge.

Schieck, F. **The ophthalmoscopic diagnosis of choked disc.** Graefe's Arch., 1937, v. 137, pt. 2, p. 203.

By careful ophthalmoscopic study with the erect image, there can be recognized early a veiling of the central vessels in the region of the physiologic cup. Constrictions of the vessels from dilatation of the perivascular glial space are frequent here, but they occur also in the later stages of neuritis. Effusions of fluid under the limitans soon covers in places the vessels at the margin of the papilla. Fluid does not occur in this manner in neuritis. In the latter, the vessels in time dip down into the nerve-fiber bundles which are swollen with inflammation. In pseudoneuritis the vessels are entirely distinct and are seen unveiled against the nerve fibers. The important differential sign in the diagnosis of choked disc is therefore the presence of exuded fluid under the internal limiting membrane. Gullstrand's ophthalmoscope is unsuitable for detection of this delicate effusion. Focal illumination with Koeppe's forward-placed lens definitely shows elevation of the limitans. Excellent results in demonstrating the effusion are obtained with Nordenson's camera and photographic plates. H. D. Lamb.

Schmelzer, Hans. **Leber's optic atrophy and the results of injury.** Graefe's Arch., 1937, v. 137, pt. 2, p. 216.

In a family coming under the author's observation, there were four men and one woman effected with Leber's optic atrophy. Almost all claimed that their disease was due to an injury sustained

in the war. The author thinks that occasionally an excessive strain might be the exciting factor. H. D. Lamb.

Schneider, D. E., and Abeles, M. M. **Charcot-Marie-tooth disease with primary optic atrophy.** Jour. Nerv. and Mental Dis., 1937, v. 85, May, p. 541.

Two cases of progressive peroneal atrophy of Charcot-Marie tooth associated with primary optic atrophy are reported, occurring in brothers aged respectively 41 and 26 years. The visual acuity of the older patient was 1/100 in both eyes. Narrowing of the retinal arteries and increased pigment in the peripapillary and macular regions were present. The visual acuity of the younger patient was 9/200 in the right eye and 20/200 in the left eye. The vessels and retinae were normal. Both patients showed nystagmus. Visual disturbances had begun in both patients before the age of ten years and had shown little progress after adolescence. Parental consanguinity, and alcoholism in the father at the time of conception may have been predisposing factors in both cases.

Edna M. Reynolds.

Sobanski, Janusz. **A case of Leber's disease treated with miotics and stimulants.** Klinika Oczna, 1937, v. 15, pt. 1, p. 34.

Sobanski reports a case, under observation for ten years, in which vision was improved by local instillation of pilocarpine and the administration of strychnine and endocrine extracts. Ocular tension was reduced from 20 to 10 mm. Hg and the diastolic blood pressure rose in the brachial and central retinal arteries. The author believes that the disease is caused by a disturbance in the retinal circulation, which should be carefully studied in such cases. Ray K. Daily.

Testa, Ugo. **Oxycephaly and alterations of the optic foramen.** Rassegna Ital. d'Ottal., 1937, v. 6, Mar.-Apr., p. 140.

Testa reports a case of oxycephaly in a boy of eleven years with marked constriction of the optic canal on the side with lost vision. The other canal and the vision of the second eye were normal. The author suggests enlarging the optic canal by means of an incision just above the brow and beneath the periosteum, removing the bone by means of saw and rongeur. He recommends incision of the dural sheath of the nerve, and that the operative procedure be practised as soon as a diagnosis is made.

Eugene M. Blake.

Zolotnitskii, I. H. **Ocular complications from the use of plasmocide.** Viestnik Opht., 1937, v. 10, pt. 3, p. 439.

A report of three cases of optic atrophy following the use of plasmocide. The author concludes that plasmocide is a toxic substance which should be used cautiously, and patients should be warned of possible idiosyncracies. In quinine amblyopia the pupils are dilated and peripheral vision is affected. In plasmocide poisoning the pupils are contracted and central vision is involved. The prognosis is less favorable than for quinine amblyopia. The ocular complication consists of an optic neuritis which rapidly passes into an optic atrophy with marked narrowing of the arteries. The clinical picture is similar to that of methyl-alcohol poisoning. Retrobulbar injections of atropine improve visual acuity and widen the visual fields. Ray K. Daily.

12

VISUAL TRACTS AND CENTERS

Byrne, J. B. **The effect of stimulation of the cortex cerebri upon the effector mechanisms which mediate movements of the iris and membrana tympani.** Jour. Nerv. and Mental Dis., 1937, v. 85, May, p. 528.

The cortical center which effects proptosis of the membrana tympani and pupil constriction is not a true center for isolated contraction of the stapedius or of the constrictor pupillae. It is, like the other cortical pupillary constrictor centers, a synkinetic center, stimulation of which brings about primary contraction of the orbicularis oculi and secondary contraction of the stapedius and constrictor pupillae.

Edna M. Reynolds.

Malbran, J. **Chiasmal lesions in cranial injuries.** Arch. de Oft. de Buenos Aires, 1937, v. 12, Mar., p. 150.

In contradistinction to the case previously reported (see Amer. Jour. Ophth., 1936, v. 19, p. 86), where the field loss was in the lower nasal quadrant, this case exhibited bitemporal hemianopsia as the result of a head injury sustained in a motor car accident. In addition to a depressed left frontal fracture and fracture of the left malar and temporal, there were noted loss of sense of smell, polydipsia, polyuria, deafness, hyperesthesia of the right occipital region, and hypesthesia in the region of the second division of the left trigeminal. Ventriculography showed deformity of the supraoptic recess and infundibulum, and disappearance of the point and dilatation of the infundibulum and transverse flattening of the left ventricle.

The eye findings seven weeks later were: bilateral pallor, blurred disc margins, two woolly patches covering the inferior temporal veins, right external-rectus paralysis, an old iridocyclitis in the right eye, and bitemporal hemianopsia, which in the left eye also involved the lower nasal field, vision being fingers at 50 cm. only in the upper left field. Vision of the right eye was 20/320. Transcranial operation revealed a yellow blood-stained dura on opening of which there was a gush of cerebrospinal fluid. Both vision and fields improved slightly after the operation. Malbran does not believe that a fracture with displacement can explain the chiasmal syndrome, since fractures with displacement or spicules are rare in basal fractures and there is ample room between the chiasm and sella, nor does he conceive of a hematoma capable of producing enough compression to produce the field defects, or of a pulling by the hypophysis tent, as suggested by Cantonnet and Coutela, as an adequate explanation. The most likely explanation is therefore that of Liebrecht and Coppez, namely transverse widening of the cranium with anteroposterior flattening and separation of optic canals and nerves, and rupture of the chiasm.

M. Davidson.

13
EYEBALL AND ORBIT

Berardi, Mario. **Ocular symptoms in hyperthyroidism.** Boll. d'Ocul., 1937, v. 16, Jan., pp. 39-111.

The writer describes the various ocular symptoms of the disease, the proper technique for their detection, and their pathogenesis, and gives histories of eleven personal and twenty-two hospital cases. He also describes the ocular symptoms obtained in experimental hyperthyroidism produced by administering thyroid preparation to six rabbits. He closes the article by discussing the effect of different methods of treatment on ocular symptomatology. (Bibliography.)

M. Lombardo.

Damel, C. S. **Histopathologic study of a cyclopean eye.** Primeiro Congresso Brasileiro de Opht., São Paulo, 1936, pp. 67-71.

In a full term fetus with profound alterations in the head, microscopic examination of the eye revealed that it was not really cyclopean, but fusion of two eyes due to lack of development of the bony structures of the medial walls of the orbits and of the nose.

Ramon Castroviejo.

Hatschek, Gustav. **Contribution to the diagnosis and pathology of intracranial tumors in the region of the sphenoid wing intruding into the orbit.** Folia Ophth. Orientalia, 1937, v. 2, Feb. p. 328.

The right eye of a 24-year-old girl was slowly and progressively protruding. Clinical examination and X-ray of the skull revealed no other symptom. The patient refused to be hospitalized until a year later when she could not close her eyelids and suffered from neuralgic pains in the eye and face. An X-ray picture taken in the antero-posterior axis revealed a retrobulbar tumor. Kroenlein operation disclosed a spongy tumor mass in the depth and the outer side of the orbit, which could not be delimited posteriorly. Cerebral shock prevented completing the operation. Autopsy revealed a fibrosarcoma of the size of a child's fist originating from

the dura in the region of the wing of the right sphenoid bone. Perforating the frontal and temporal bones it intruded into the cranium and caused a considerable impression on the temporal lobe.

It is the author's opinion that an X-ray picture of the skull in two planes should be taken in every case of unilateral exophthalmos. If an orbital tumor is present one should carefully examine for intracranial extension in spite of the absence of cerebral and neuralgic symptoms. R. Grunfeld.

Ladekarl, P. M. **Thrombosis of the cavernous sinus.** Acta Ophth., 1937, v. 15, pt. 2, p. 227.

A report of two cases with recovery. In one the thrombosis was a complication of a mild infection and in the other a result of arteriosclerosis.

Ray K. Daily.

Miklos, Andor. **Anterior orbital cephalocele.** Graefe's Arch., 1937, v. 137, pt. 2, p. 222.

In spite of its comparative infrequency, its possibility must always be kept in mind in a case of swelling at the inner angle of the eye. The author's two cases were in an infant six months and a boy fifteen years old. Satisfactory differentiation is only to be obtained by a test puncture. Postponement of operation in infancy is justified only in the case of small and very slowly growing cephaloceles. Contraindications to operation include serious developmental anomalies, hydrocephalus, and pronounced weakness of the infant.

H. D. Lamb.

Sewall, E. C. **Operative control of progressive exophthalmos.** Arch. of Otolaryng., 1936, v. 24, Nov., p. 621.

Sewall makes the regular incision of the skin over the orbit. The frontal and ethmoidal cells are entered in the usual manner and their orbital walls are completely removed. The ethmoidal cells are exenterated. After the lamina papyracea is removed, the floor of the orbit is resected outward as far as the position of the infraorbital artery and nerve will allow. The roof of the orbit and dural plate may be removed by this technique. Sewall states that the sinuses can be more satisfactorily exenterated by this method than by the method of Naffziger and Jones.

Theodore M. Shapira.

Soderi, Aldo. **A rare tumor of the orbit.** Boll. d'Ocul., 1937, v. 16, Feb., pp. 198-211.

The right eye of a man of 56 years had been blind for several years. At examination he showed a lagophthalmos keratitis and total ophthalmoplegia with retraction of the muscles. This picture was accompanied by intense pain in the eye and the corresponding temple. At exenteration of the orbit a small tumor was found, roundish and of gray color, adherent to the posterior part of the eyeball and including in its mass the optic nerve and the posterior ciliary nerves. No intraocular or extraorbital diffusion of the tumor was seen. In the histologic examination the tumor is described as a retrobulbar lymphangioendothelioma originating from the orbital hemolymphatic vessels. (Bibliography, four figures.) M. Lombardo.

Wright, R. E. **Fibrocystic disease of the frontal bone (Paget's osteitis)** Brit. Jour. Ophth., 1937, v. 21, July, pp. 364-367.

The case presented is that of a Hindu girl who reported that the left brow had gradually become more prominent during a ten-year period. When seen the globe was pushed downward by a marked swelling which the patient maintained was a week's growth. It was decided to cut down through the cyst, and remove a part of the frontal bone. The procedure is described. A year after operation the patient was maintaining good health. There was no change in calcium and phosphate metabolism, and the histopathology revealed localized fibrocystic disease of the bone. (3 figures.) D. F. Harbridge.

14

EYELIDS AND LACRIMAL APPARATUS

Aliquo-Mazzei, A. **Trachoma and affections of the lacrimal passages.** Ann. di Ottal., 1937, v. 65, Jan., p. 38.

Earlier writers have shown that trachoma may so invade the conjunctiva as not only to cause stenosis of the canal but even to obliterate the lacrimal passage. Sometimes the canal may be primarily affected. Of 380 cases of trachoma which the author examined, in by far the greater number the lacrimal passages were found to be patent. In twelve percent of the cases there was greater or less stenosis of the passage. In five percent there was complete obliteration. In three cases follicles were found in the lacrimal passages. The histologic alterations were similar to those found in long standing dacryocystitis. The author considers invasion of the lacrimal tract in trachoma as of infrequent occurrence. (3 plates, bibliography.) Park Lewis.

Hamburger, F. A. **Supernumerary and abnormally placed lacrimal canaliculi.** Zeit. f. Augenh., 1937, v. 92, May, p. 27.

Because of their rarity, the author describes supernumerary lacrimal canaliculi in five patients. The proximal openings were in the skin near the inner canthus in all except one case, in which the opening was in the caruncle. Three of these canaliculi joined the tear sac relatively far below the mouths of the normal canaliculi which were also present. F. Herbert Haessler.

Linksz, A. **Dermatotherapy in the daily practice of the ophthalmologist.** Klin. M. f. Augenh., 1937, v. 98, April, p. 433.

Seborrhea and seborrheic affection of the lid margins occur not only in youthful persons (probably of hormonal origin), but also in older people with disturbances of circulation; and in association with certain brain tumors and lethargic encephalitis. For correct therapy it is necessary in every case to ascertain the functional condition of the sebaceous glands. The different kinds of ointment, powder, and paste are enumerated. For cleansing the secretions in a dry skin cod-liver oil, in seborrhea benzin, is recommended. The various dyes used for eyebrows and lashes and the treatment of various deleterious consequences are discussed. In these cases the author found the white precipitate ointment very useful. C. Zimmermann.

Orzalesi, F. **Transparent cyst of lid margin of uncommon dimensions.** Boll. d'Ocul., 1937, v. 16, Feb., pp. 167-175.

A woman of 76 years showed a spherical pinkish transparent cyst connected by a short pedicle with the free margin of the left lower lid in its nasal half. The horizontal length was 21 mm., the vertical 14, and the depth 19 mm. From the serous contents, the pretarsal location, and the histologic findings, the author thinks it had developed from a Moll gland by occlusion of the excretory duct through hyperkeratosis of the lid margin. (Bibliography and 7 figures.) M. Lombardo.

Poliak, B. L. **On the question of radical operation on the lacrimal passages.** Viestnik Opht., 1937, v. 10, pt. 3, p. 448.

The author consummates extirpation of the lacrimal sac by complete excision of the mucous membrane of the nasolacrimal canal. He claims that this procedure is a safeguard against recurrence. Ray K. Daily.

Posarelli, Arrigo. **Dacryocystitis. Histologic researches and pathogenetic considerations.** Riv. Oto-Neuro-Oft., 1936, v. 13, Nov.-Dec., pp. 555-574.

Six cases are reported of acute or chronic dacryocystitis and peridacryocystitis with evidence of inflammatory complication of two or even all the nasal sinuses. Diagnosis was confirmed by radiographic and transillumination tests and supplemented by histologic examination of the sac walls and the mucous membrane of the sinuses. The writer concludes that clinico-histologic research reveals an anatomic relation between the nasal and paranasal cavities and the sac, and that diffusion of the inflammatory processes from one structure to the other is by contiguity and continuity. Dacryosinusitis and dacryopolysinusitis are the proper terms to indicate these pathologic enti-

ties. (Bibliography, 5 figures, 4 photomicrographs.) M. Lombardo.

Rintelen, F. **Elephantiasis of the lids and a contribution to knowledge of the osteo-dermopathic syndrome of Touraine-Solenta-Golé.** Zeit. f. Augenh., 1937, v. 92, May, p. 1.

A critical survey of the literature makes it seem advisable to distinguish true elephantiasis from similar lid changes which are usually the result of neoplastic tumefaction. The author wishes to reserve the term elephantiasis for thickening of the cutaneous and subcutaneous connective tissue as a result of inflammation and edema from mechanical or parasitic injury. He describes a case of pachydermia with extensive folding of the skin of the head, forehead, cheeks, hands, and feet, and with malformation of the hands and enlargement of the feet by periosteal thickening of the metatarsal, metacarpal, and phalangeal bones. These changes were associated with elephantiasis of the upper lids brought about by tremendous hypertrophy of the tarsal connective tissue and unsightly gigantism of the meibomian glands with cyst formation. F. Herbert Haessler.

Shimkin, N. I. **Tarsorrhaphia medialis vera.** Brit. Jour. Ophth., 1937, v. 21, July, pp. 343-352.

Demonstrating three steps of operative procedure, the author presents a new method for treatment of prolonged cases of paralytic ectropion of the lower eyelids. The method differs from others in that the most severe condition may be corrected without additional operation on the outer third of the lid. While no restoration of lacrimal ducts is possible in these cases, the lacrimal passages of the upper lid remain intact. A case history is presented. The method is said to be simple. (3 figures, 1 photograph, references.) D. F. Harbridge.

Spanic, Andrzei. **Surgery of ptosis.** Klinika Oczna, 1937, v. 15, pt. 1, p. 1.

A discussion of the various operations and a detailed description of the author's modification of the Blaskovicz operation, which he claims simplifies the technique and shortens the operative time. The modification is based on the fact that the tarso-orbital fascia and levator are more easily separated if the separation is begun with the tarsus. He therefore incises the tarsus and lifts its upper portion and the levator from the tarso-orbital fascia. In seven cases thus operated upon the results were as good as those obtained with the original Blaskovicz technique.

Ray K. Daily.

Spinelli, F. **Contribution to cases of diverticuli of the lacrimal sac with special regard to radiologic investigation.** Arch. di Ottal., 1937, v. 44, Feb., p. 89.

A case of diverticulum of the lacrimal sac with valve formation allowing passage of liquid substances from the sac into the diverticulum but obstructing flow from the diverticulum into the sac is reported by the author. The diagnosis of the condition was made prior to operation and by means of radiologic investigation. H. D. Scarney.

Strachov, V. P. **An answer to Poliak.** Viestnik Opht., 1937, v. 10, pt. 3, p. 450.

Strachov and Poliak (see above) disagree on the merits of their respective techniques in extirpation of the lacrimal sac. Ray K. Daily.

Voisin, Jean. **Spasmodic retraction of the upper lid.** Arch. d'Opht. and Rev. Gén. d'Opht., 1937, v. 1, n.s., May, p. 391.

The pathogenesis of spasmodic retraction of the upper lid may be either hypertonicity of Müller's upper-lid muscle or hypertonicity of the elevator. The first accounts for the retraction seen in the syndromes Claude-Bernard, Basedow, and para-basedowian. The second is seen following trauma or irritation of the encephalon. The term paradoxic ascension should replace spasmodic retraction when applied to lid movements resulting from ocular movements, such as Fuchs's sign. (Bibliography.)

Derrick Vail.

Wright, R. E., and Koman Nayar, K. **Acute dacryoadenitis due to the Morax-**

Axenfeld diplobacillus. Brit. Jour. Ophth., 1937, v. 21, July, pp. 367-368.

This is a clinical note of three cases. Two had recovered, while the third was well advanced toward recovery. A small amount of broth was injected into the preauricular gland abscess. The mixture was planted on blood agar, serum agar, and Soparkar's medium, and showed a pure culture of diplobacillus of Morax and Axenfeld. From the cases presented it is reasonable to suppose that in at least one, if not in all three, the cause of the disease was the Morax-Axenfeld bacillus. D. F. Harbridge.

15
TUMORS

Böje, Ove. **A case of ring-sarcoma of iris and ciliary body.** Acta Ophth., 1937, v. 15, pt. 2, p. 239.

The patient was an infant six months old. Within three weeks after the discovery of a small brownish-yellow spot in the iris the entire temporal quadrant of the iris was involved. The rapid growth of the tumor was probably due to the extreme youth of the patient. In its further growth it extended to the surface of the globe along the anterior ciliary veins. (Illustrations.)
Ray K. Daily.

Buschke, Wilhelm. **Metastatic retothele-sarcoma of the eye.** Klin. M. f. Augenh., 1937, v. 98, Apr., p. 457.

A metastatic retothele-sarcoma (reticulolymphosarcoma) in the eye of a man of 59 years developed from a primary tumor of the lymphatic apparatus of the jejunum. The anatomo-pathologic peculiarity was a predominantly intravascular growth in the uvea, which the author relates to the character of the tumor cells. Clinically the metastasis appeared as a lumpy detachment of the retina and choroid, which on account of the flat intravascular extension did not show a tumorlike shadow on diascleral transillumination. (Illustrations.) C. Zimmermann.

Fuchs, A. **The clinical significance of circumscribed detachment of the retina at the ora serrata in incipient sarcoma of the choroid.** Klin. M. f. Augenh., 1937, v. 98, May, p. 606.

In 1935 Fuchs published histologic findings in four cases of circumscribed detachment of the retina at the ora serrata in choroidal sarcoma (see Amer. Jour. Ophth., 1935, v. 18, p. 1076). He later found this condition in nine out of 33 cases of choroidal sarcoma, five of which are reported in detail. He concludes that such a detachment of the retina at the ora serrata opposite the tumor may be an important supporting symptom for diagnosis of sarcoma of the choroid, especially at the very beginning of the sarcoma and in cases in which transillumination reveals no shadow in consequence of lacking pigmentation of the tumor. Enucleation would not directly be decided upon, but the diagnosis would be supported and rendered probable. (Illustrations.)
C. Zimmermann.

Holm, Ejler. **A case of sarcoid of Boeck.** Acta Ophth., 1937, v. 15, pt. 2, p. 235.

A tumor the size of a bean, located on the right lower orbital margin of a man 63 years old and causing a diplopia similar to that seen in paresis of the trochlearis, presented the microscopic picture of a Boeck's sarcoid.
Ray K. Daily.

Jensen, V. A. **Malignant teratoid tumor in the hypophyseal region.** Acta Ophth., 1937, v. 15, pt. 2, p. 193.

A thirteen-year-old girl died with symptoms of intracranial tumor, bilateral ophthalmoplegia, bitemporal hemianopsia, and corneal anesthesia. Autopsy revealed a large interpeduncular tumor with invasion of the sphenoid sinus and both orbits. Histologically it was a malignant teratoid. (Illustration.) Ray K. Daily.

Klien, B. A. **Concerning conditions simulating an intraocular tumor.** Amer. Jour. Ophth., 1937, v. 20, Aug., pp. 812-819.

Kurz, Otto, **Symmetrical iris tumors.** Klin. M. f. Augenh., 1937, v. 37, April, p. 476.

A woman of 21 years presented a fleshy tumor of the lower temporal quadrant of the right iris, with a corresponding symmetrical formation on the left iris. Both showed remnants of pupillary membrane, so that the possibility of persistent mesodermal remnants as cause of the development of the tumors was assumed. As its histologic structure approached that of an endothelioma the possible origin from endothelium-like elements of the anterior stratum of the iris is discussed. The tumor was removed by iridectomy, as gonioscopic examination indicated freedom of the sinus, and the tumor tended to grow toward the surface.

C. Zimmermann.

Neely, J. M. **Mixed tumor of the lacrimal gland.** Amer. Jour. Path., 1937, v. 13, Jan., p. 99.

Neely reviews the literature on mixed tumor of the lacrimal gland and reports the case of a 64-year-old man. He concludes that a correlation of the histology of this type of tumor with the development of the gland strongly supports the theory that it is developmental, representing misplaced embryonal tissue rests. He says that it is not a strictly epithelial tumor. Further he states that there is no clinical or pathologic evidence that it is an adenocarcinoma and therefore this term should be abolished. Theodore M. Shapira.

Poos, F. **On the formation of lymph nodules in cavernous hemangioma of the orbit.** Klin. M. f. Augenh., 1937, v. 98, April, p. 466.

Two cases are reported. A cavernous hemangioma of the orbit in a man of 43 years was removed by Krönlein's operation. It showed a firm fibrous capsule, numerous blood-filled alveoli, and a solid fibrous tissue in the center, with lymphocytic or plasmacellular infiltrations. In the second case, a girl of twelve years with exophthalmos, the angioma, also removed by the Krönlein method, showed an advanced stage of the typical conversion process of many such angiomas, commencing with disturbances of circulation (thrombosis, hemorrhages) and replacement of larger parts of the tumor by inflammatory cicatricial tissue with follicles. Thus, in accordance with Birch-Hirschfeld, the tissue of lymphatic glands frequently encountered in cavernous angiomas is considered not as a heteroplastic formation but as a reaction to chronic inflammatory irritation. C. Zimmermann.

Scales, J. L. **Melanosarcoma of the eye.** New Orleans Med. and Surg. Jour., 1937, v. 89, April, p. 567.

The author reports a case of melanosarcoma of the limbus in a 44-year-old negress. Since enucleation of the bulb, there has been no metastasis in four and a half years of observation.

Theodore M. Shapira.

Scheyhing, Hans. **Glioma of the retina cured by roentgen rays.** Klin. M. f. Augenh., 1937, v. 98, June, p. 756.

So far only eight cases of glioma of the retina have been cured by roentgen rays. Scheyhing reports a case which had been under observation for almost ten years. A boy, whose right eye had shortly before been enucleated on account of glioma filling the vitreous, was brought to the eye clinic of München for radiation of glioma of the left eye. Microscopic examination showed a typical glioma of the retina. Above and to the nasal side of the optic disc was a prominent grayish-white tumor of 3-disc diameters with some blood vessels. It was surrounded by a number of very small prominent grayish white dots in the retina. Vision was 5/5. Under roentgen radiation from December, 1927, to January, 1931, the tumor became flatter with calcified infiltrations and pigment changes in the surroundings, vision remaining 5/5. Toward the end of 1931 ectatic bluish vessels appeared in the conjunctiva and slight opacities in the posterior corticalis of the lens. As the growth of the tumor had been arrested radiations were discontinued. In 1934 the patient returned. The opacities of the lens had increased, and in 1935 the cataract was extracted. In December, 1936, a membranous secondary cataract was operated on without complication. Corrected vision was 0.6. The tumor which had grown smal-

ler and showed regressive changes, was encircled by extensive atrophy of the choroid, apparently caused by the radiation. (Illustrations.)

C. Zimmermann.

Weve, H. J. M. **Operative treatment of intraocular tumors with conservation of the eyeball.** Arch. f. Augenh., 1937, v. 110, July, p. 482.

The left and only eye of a 34-year-old woman showed rapid loss of vision. Her skull had been trephined thirteen years earlier for an alleged cerebellar tumor, but the tumor was neither localized nor removed. Ophthalmoscopy now revealed Hippel's disease. The temporal arteries and veins were enormously broadened and led to a fiery-red cystic protrusion of the retina. The author treated the tumor with surface-diathermy coagulation and he perforated the eyeball under ophthalmoscopic guidance and coagulated the two broadened arteries. Vision improved from 1/60 to 3/60.

In a 55-year-old woman, keratoconus of the left eye reduced the vision to barely 3/300, while a contact glass improved it to 1/4. A melanosarcoma of the choroid was diagnosed at the temporal side of the right eye. The extremely poor vision of the left eye justified the employment of surface coagulation. Keeping the tumor localized under constant transillumination, the author destroyed the tumor by surface coagulation as far as its margins. For fear of tumor remnants the author repeated the operation, the tumor being again extensively coagulated and then perforated twelve times with electrodes 3 to 5 mm. long. Two months later the tumor was entirely atrophic, no difference of level being detected. The numerous retinal folds that followed the operation reduced the vision considerably, but the nasal half of the visual field was retained.

R. Grunfeld.

16
INJURIES

Ascher, K. **Concerning caterpillar-hair injuries of the eye and the mechanism of hair migration.** Med. Klin., 1937, v. 33, Feb. 26, pp. 297-300.

Caterpillar hairs have been found in the eye, not only in conjunctiva, cornea, and sclera, but also in the deeper structures such as iris, ciliary body, and choroid. The ophthalmoscopically visible choroidal lesion is almost always linear, indicating a migration of the hair along a straight line. According to Weve the factors causing the intraocular migration of the hair are pressure of the lids, movements of the eyeball, contraction of iris and ciliary body, circulation of the aqueous, and accommodative movements of lens and retina. For migration of the hair in the parenchyma of cornea and sclera which the author observed under the slitlamp, and possibly also for migration in the choroid, he suggests another cause. The infiltrate which forms around the hair is very delicate at the pointed fine end of the hair and rather heavy at the broken end, where it forms first. Thus in loose tissue such as the conjunctiva nodules are formed. In the dense tissues, where separation of the fibers is more difficult, the heavy infiltrate at the broken end of the shaft may push the hair forward in the direction in which the tip points. (References.)

Bertha Klien.

Denti, A. V. **Localization of opaque intraocular foreign bodies.** Rassegna Ital. d'Ottal., 1937, v. 6, Mar.-Apr., p. 124.

The various methods of localizing opaque intraocular foreign bodies are reviewed and the merits of each method weighed. The author then cites his experiences in the injection of radio-opaque substances into Tenon's capsule, making use of blind eyes and those suspected of harboring foreign bodies for a long time. The two substances injected were colloidal suspension of 20 percent thorium and an iodized fatty acid ether, in which 1 c.c. contained 23 cgm. of iodine. He found the use of these substances practical and helpful in outlining the globe and in localizing foreign bodies. (8 figures.)

Eugene M. Blake.

Dor, M. L. **Scleral extraction of foreign bodies from the vitreous.** Bull. Soc. Franç. d'Opht., 1936, v. 49, pp. 181-192.

The author prefers scleral extraction, although retinal detachment is an objection. The use of the electromagnet instead of X-rays as a diagnostic means is deplorable. It creates cicatricial bands and disorganizes an eye. Various statistics are assembled and compared.

Clarence W. Rainey.

Focosi, Marcello. **Extraction of foreign bodies through the sclera by the giant electromagnet.** Boll. d'Ocul., 1937, v. 16, Feb., pp. 153-166.

Four cases of magnetic intraocular foreign bodies are reported, extracted through the sclera, with resulting vision of 20/20 and not less than 20/40, in patients of from 23 to 53 years. A linear incision is made in the sclera without perforating the choroid. The length of the incision is proportioned to the size of the foreign body as calculated by roentgenogram. (Bibliography.)

M. Lombardo.

Lundberg, Åke. **A case of traumatic cyst of the iris.** Acta Ophth., 1937, v. 15, pt. 2, p. 204.

Review of the literature and report of a case. A man forty years old was injured by a carbide explosion, producing a small iridodialysis and hyphemia in one eye. Five years later the eye developed a cyst of the iris with glaucoma, and after unsuccessful surgical attempts to reduce the tension the eye was enucleated. Histologic examination revealed an epithelial invasion of the anterior chamber, probably the result of one of the surgical procedures; multiple conjunctival cysts of the anterior chamber; and a true iris cyst.

Ray K. Daily.

Perez Porcel, Enrique. **Eye injuries in war.** Arch. de Oft. de Buenos Aires, 1937, v. 12, Feb., p. 65.

In a summary of observations of eye injuries during the recent Chaco war between Bolivia and Paraguay, the author calls attention to the large incidence of nontraumatic affections due to the tropical terrain. Many cases of optic neuritis, retrobulbar neuritis, retinal hemorrhage, ophthalmoplegia, and neuralgia due to malaria were observed. Avitaminosis, with xerosis and hemeralopia, at first misinterpreted as simulation, was encountered and was relieved by proper food.

Twelve cases of serious eye injury are reported and are illustrated with photographs. They confirm the observations and laws made by Lagrange during the World War, namely, that indirect eye lesions may result from explosions at a distance via air commotion and from fracture of the facial bones not directly involving the globe. These lesions are principally at the posterior pole, and eye lesions from direct contact of a projectile or bone fragment with the eye produce in addition to the posterior pole lesions chorioretinal lesions at the point of contact. Of the twelve cases reported, one, with macular hemorrhages, resulted from explosion of a shell at a distance of five meters, without direct injury to the individual; one from a fall without direct injury to the eye; and the rest from fracture of the facial bones by shell fragments, bullets, and grenades.

M. Davidson.

Salzmann, M. **Migration of foreign body upon the cornea.** Wiener klin. Woch., 1937, v. 50, May 22, pp. 787-788.

In seven cases the author found migration over a large portion of the cornea. In five the foreign body was part of the wing or body of an insect, in one, part of a plant. The resemblance between keratitis fascicularis and a wandering foreign body is great. From the limbus to the foreign body a shallow groove with parallel margins runs in a tortuous way. It has the width of the foreign body and contains a few superficial blood vessels. Usually in the case of a foreign body in the eye several weeks or months prior to the first examination a history can be obtained. If the migration of the foreign body has not been observed by the patient it can be deducted from: (1) the length of time which has elapsed since the moment the foreign body was first felt, (2) the nature of the foreign body, which usually is part of an insect, and (3) the groove which is created by its migration.

Bertha Klien.

Schmelzer, Hans. **Corrosion of the eye by concentrated tear gas.** Klin. M. f. Augenh., 1937, v. 98, Apr., p. 510.

Fluid tear gas shot from a pistol about 3 meters distant entered the eye of a young man, causing intense chemosis. The first few days the cornea remained clear, but suddenly developed a central rapidly progressing ulcer with hypopyon. Healing occurred after two months with totally opaque cornea and blindness. A chemical analysis revealed chloracetophenon. Immediate irrigations with a warm alkaline solution and alkaline eye salve are recommended. (Illustrations.) C. Zimmermann.

Venco, L. **Concerning lesions of the motor oculi muscles by direct trauma.** Arch. di Ottal, 1937, v. 44, Feb., p. 65.

Two cases of extraocular muscle injury are described by the author. The first case involved a tearing of the tendon of the internal rectus and a laceration of the reflected portion of the superior oblique. The second case involved a resection of the inferior rectus muscle at the point of attachment of the muscle and tendon. Methods of treatment are discussed. H. D. Scarney.

17

SYSTEMIC DISEASES AND PARASITES

Dvishkov, P. P., and Gubin, V. M. **The erythrocyte sedimentation reaction in ocular tularemia.** Viestnik Opht., 1937, v. 10, pt. 3, p. 393.

An experimental study on rabbits. The results indicate that the sedimentation rate is of definite prognostic value, rising with the gravity of the case and falling with recovery. It thus also indicates the effectiveness of the treatment.

Ray K. Daily.

Fuchs, A. **On lepra bacilli in eyes clinically appearing normal.** Klin. M. f. Augenh., 1937, v. 98, June, p. 728.

Fuchs describes the histologic condition of the eyeballs of two patients of Java who died from leprosy. The eyes appeared clinically normal, but three contained numerous lepra bacilli in the interior. Only the episclera showed inflammation. He is convinced that the bacilli enter the ciliary body and episclera through the blood stream. The fact is worth noting that in tissue appearing clinically and anatomically normal lepra bacilli may occur in great quantity without creating a reaction. This shows that the germs as such do not evoke the disease and that the behavior of the tissue is the determining factor. (Illustration.)

C. Zimmermann.

Kalashnikov, V. P. **The eye and gout.** Viestnik Opht., 1937, v. 10, pt. 3, p. 387.

A review of the literature and a report of cases. The author considers gout an allergic disease. Ray K. Daily.

Krynski, Kazimierz. **A case of filaria in the ocular conjunctiva.** Klinika Oczna, 1937, v. 15, pt. 1, p. 47.

A report of a case of Filaria loa in the ocular conjunctiva of a man who had returned from Africa.

Ray K. Daily.

Malbran, J., and Picoli, H. R. **Arachnodactyly** (Marfan's syndrome). Arch. de Oft. de Buenos Aires, 1937, v. 12, Jan., p. 3.

The literature is reviewed. Two families presented incomplete forms of arachnodactyly. In one, three brothers and three children of one of the brothers presented ectopia lentis, with lordosis in some, flat and large feet in others, positive Wassermann and Kahn reactions in two, and cardiac lesions in the three children. The second family consisted of a mother with a positive Wassermann, lordosis, and very large feet; and a daughter with bilateral microphthalmos, microcornea, unilateral ectopia, and cataract. (Illustrated.)

M. Davidson.

Ochapovskaja, N. V. **Ocular filaria in U.S.S.R.** Viestnik Opht., 1937, v. 10, pt. 4, p. 606.

The author reports five cases of filaria in the subcutaneous tissue or conjunctiva, without serious ocular disturbance. In each case the parasite was single, without a tendency to multiply, and there was no eosinophilia in the blood. The author regards these cases

as accidental rather than as true cases of filariasis. Ray K. Daily.

Pascheff. C. **Ophthalmomyiasis externa Oestri ovis.** Klin. M. f. Augenh., 1937, v. 98, June, p. 721.

A boy of ten years while going through a meadow felt a sudden blow on the right eye. The lids became swollen and the conjunctiva red, with follicles in both fornices and mucofibrinous secretion. The everted tarsus presented two black streaks which moved and curved behind a short conical whitish body. After removal with a spatula, the follicles and hyperemia of the conjunctiva gradually disappeared. Microscopic examination revealed a larva of the Oestrus ovis. This is the first case of this type to be observed in Bulgaria. (Illustrations.) C. Zimmermann.

Tournay, Auguste. **Ocular neurology and the oto-neuro-ophthalmic movement.** Arch. d'Opht. and Rev. Gén. d'Opht., 1937, v. 1, n.s., Apr., p. 289.

In the past fifteen years enormous strides have been made to correlate the work of ophthalmologists and otologists interested in neurology. What the author calls "the movement" is this trend and he reduces it to the reciprocal formula o-n-o. Since 1922 special journals (French, Italian) have been established and are doing well. Special o-n-o congresses have met annually, the first in Strasbourg in 1927. A discussion of the movement and the advancement as well as the future of ocular neurology follows. Derrick Vail.

Varshavskii, I. K. **Alveolar echinococcus of the conjunctiva.** Viestnik Opht., 1937, v. 10, pt. 3, p. 415.

This is the first case to be reported of an alveolar echinococcus of the conjunctiva. As a rule this parasite is found in the liver. General examination was negative, and the source of the parasite was not found. Ray K. Daily.

Werdenberg, E. D. **Ocular tuberculosis and its intrathoracic source.** Bull. Soc. Franç. d'Opht., 1936, v. 49, pp. 122-125.

Three forms of ocular tuberculosis are the diffuse exudative, the nodular, and the fibrotic. The different specific sensibility of these three forms to cutaneous reaction from small therapeutic doses of tuberculin completes the knowledge of their characteristics. Ocular tuberculosis is characterized by miliary hematogenous dissemination with localization in the peripheral vessels. The source is most frequently intrathoracic and in the ganglia of the hilum, where a focus of infection may penetrate the lymphatic system and cause ocular recurrences, bacteremia, and miliary dissemination.

In 600 radiographs of the lungs made in cases of ocular tuberculosis, there was in sixty percent slight involvement of the hilum, glands, and lungs. In thirty percent there were moderate lesions, hilum tumor, and miliary dissemination in the lungs. In less than ten percent of the cases there were grave cavernous lesions of the lungs. In thirty of these the condition was of pneumothorax. Grave ocular tuberculosis is often associated with mild pulmonary symptoms, and mild ocular tuberculosis with serious pulmonary symptoms.

Clarence W. Rainey.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Alexandrov, V. V. **Problems and methods of the ophthalmologic dispensary.** Viestnik Opht., 1937, v. 10, pt. 3, p. 435.

A program of work.

Alvaro, M. E., and Pardo, D. **Occurrence of errors of refraction in the Infirmary of Santa Lucia.** Primeiro Congresso Brasileiro de Opht., São Paulo, 1936, pp. 87-88.

The authors report the incidence of errors of refraction among 25,100 patients between 1927 and 1934. 3,566 (14.2 percent) were found to have errors of refraction. Of these, 1,619 (45.4 percent) had hyperopia; 1,359 (35.3 percent) had astigmatism; and 488 (13.7 percent) had myopia.

Ramon Castroviejo.

Bab, Werner. **Eye examinations in candidates for Palestine certificates in Germany.** Folia Ophth. Orientalia, 1937, v. 2, Feb., p. 344.

A minimal visual acuity of 0.5 in each eye with correction is required of immigrants into Palestine, but the refractive anomaly must not exceed nine diopters. Among 2,500 applicants 20 were rejected by the author as unfit and 14 borderline cases were referred by him to the chief examiner for decision.

R. Grunfeld.

Damel, C. S. **Blood-staining of cornea.** Arch. de Oft. de Buenos Aires, 1937, v. 12, Jan., p. 18.

In a suit for damages after infliction of an injury by one minor on another, with resulting hyphemia and blood-staining of the cornea, the author argued that the compensation should be twice the sum allowed under the Workmen's Compensation Act, since the amount fixed by the latter is based on the assumption that the injured worker is a joint insurance-carrier responsible for half the loss. M. Davidson.

Ferree, C. E., and Rand, G. **The testing of fitness for night flying: the light sense.** Amer. Jour. Ophth., 1937, v. 20, Aug., pp. 797-808.

Frogé and Chiniara, J. **Causes of variations in distribution of trachoma in Syria.** Rev. Internat. du Trachome, 1937, v. 14, Jan., p. 39.

The author discusses the living conditions and ideas of hygiene of the different nationalities and religious sects of Syria. J. Wesley McKinney.

Gradle, H. S., and Francois, W. de. **The visual ravages of trachoma.** Jour. Amer. Med. Assoc., 1937, v. 109, July 24, p. 253.

In the trachoma clinics of Southern Illinois, the authors found that 7.8 percent of the patients were industrially blind as the result of trachoma and its complications. In more than one fourth of these cases useful vision could be restored by treatment. Of the individual trachomatous eyes, about thirty percent had a reduction in vision that interfered with satisfactory reading, about two fifths of the reduction being due to trachoma; and seventeen percent were industrially blind, about three fifths of the reduction being due to trachoma. Vision can be restored to the useful point in from one fourth to one third of the eyes, the percentage varying according to the degree of loss and the length of time it has existed.

George H. Stine.

Greeff, R. **When did Albrecht von Graefe enter the Charité-Hospital?** Klin. M. f. Augenh., 1937, v. 98, May, p. 672.

According to the Archives of the Charité Hospital, Berlin, in which excerpts are given of correspondence with Graefe, he entered April 8, 1859, as directing physician.

C. Zimmermann.

Grosz, Emile. **The fight against trachoma in Hungary.** Rev. Internat. du Trachome, 1937, v. 14, Jan., p. 2.

This is a description of combative measures taken in Hungary since 1886.

Johansson, Ernst. **Ophthalmologic discourse in two old obstetric works.** Klin. M. f. Augenh., 1937, v. 98, April, p. 533.

Extracts from the work of Rosslin (1513) and others are given in chronological order. C. Zimmermann.

Majewski, Kazimierz. **The role of the antitrachomatous station in Witkiwice.** Klinika Oczna, 1937, v. 15, pt. 1, p. 103.

A description of the foundation and work of this trachoma dispensary.

Marks, E. O. **The causes of blindness in Queensland.** Med. Jour. Australia, 1937, v. 1, May 22, p. 789.

Because of the high percentage of blindness due to ophthalmia neonatorum in the Brisbane School for the Blind, a survey of the causes of blindness in 270 other blind pensioners was made. Optic atrophy was found to be the most common cause of blindness—sixteen percent—while ophthalmia neonatorum was responsible for only one percent. Edna M. Reynolds.

Reis, Wiktor. **The eye in expressionistic art.** Zeit. f. Augenh., 1937, v. 92, June, p. 158.

On two plates, the author reproduces twelve examples of painting and sculpture in which the eye is represented by geometric figures which suggest an eye to a greater or less degree, but in no way represent the structure. The modern artist views himself as a constantly changing complex which receives stimuli, modifies them, and passes them on. The stage is long past when pathology invaded art so that Charcot was able to diagnose neurologic lesions on the sculptures in medieval cathedrals. Rather has there been an exodus of normal anatomy. F. Herbert Haessler.

Rodrigues, Alfredo. **Trachoma in Madeira.** Rev. Internat. du Trachome, 1937, v. 14, Jan., p. 36.

The author describes the topography, climate, and social conditions of the island and suggests that the altitude and climate are conducive to the spread of trachoma there.

J. Wesley McKinney.

Rötth, A. **Ocular findings in twins.** Klin. M. f. Augenh., 1937, v. 98, May, p. 636.

In the hygienic institute of Pazmany Peter University, Budapest, 43 enzygotic, 49 fraternal, and 5 doubtful pairs of twins of the same sex were examined with regard to refraction of the cornea, total refraction, ocular muscles, intraocular tension, color perception and so on. The results indicate that there is no ophthalmologic symptom by which the identity can be definitely determined. Most frequently there is similarity of the arches of the eyebrows, color of irises, and shape, color and contour of the optic discs in enzygotes, that is predominating ectodermic formations. New were the investigations of muscular balance, differences of which were more rare. Of pathologic symptoms a concordant case of corneal astigmatism was observed of a higher degree (4.5, 3.5 D.) than had previously been noted in enzygotes. Disturbances of the color sense occurred in concordant fashion in enzygotes. C. Zimmermann.

Sergievskii, L. I. **A critical survey of text books of the elementary and intermediate schools.** Viestnik Opht., 1937, v. 10, pt. 4, p. 609.

The author finds in this survey that from a hygienic standpoint text books have deteriorated in quality. The author urges that publication of text books be controlled by hygienic and not by economic factors, and that the quality of paper be improved and careless typography eliminated.

Ray K. Daily.

Spiratos, S. **On trachoma and trachomatous keratitis.** Rev. Internat. du Trachome, 1937, v. 14, Jan., p. 23.

This is a statistical study based on 103,657 cases observed from 1928 to 1934 in Greece.

Szymanski, J. **The traveling ocular squadron in the Vilna district.** Klinika Oczna, 1935, v. 15, pt. 1, p. 109.

A report of the work of the two Red Cross squadrons in this trachoma-infested and medically neglected region.

Ray K. Daily.

Zachert, Marjan. **The fight against trachoma.** Klinika Oczna, 1937, v. 15, pt. 1, p. 112.

School supervision led to a reduction of the incidence of trachoma among schoolchildren to 0.5 percent. Among those reporting for military service the incidence of trachoma is one percent, showing the increase in the years intervening between school attendance and military service. The author urges the enlistment of sport and military organizations in the fight.

Ray K. Daily.

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